Report 1095-03-80-CR

Foreign Military Sales Manpower Projection Methodology

TEST AND VALIDATION OF ALTERNATIVE METHODOLOGIES

STUDY DOCUMENTATION REPORT

Volume II — Appendixes

September 1980

MANAGEMENT SYSTEMS DIVISION

GENERAL RESEARCH CORPORATION

A SUBSIDIARY OF FLOW GENERAL INC.

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Director of Manpower Management
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18. SUPPLEMENTARY NOTES

Volume II contains 6 Appendixes covering details and statistics of the regression analyses of the Security Assistance program at various levels of aggregation

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Security Assistance
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Manpower

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

During the period March-September 1980, the General Research Corporation (GRC) tested a wide variety of statistical methods for projecting Foreign Military Sales programs and forecasting manpower requirements in future years. This two-volume report summarizes the test and validation activities, provides the principal results, and recommends further test and validations to be performed before the final selection of methodologies.

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SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

APPENDIX A

REGRESSION ANALYSIS OF THE 30-YEAR PROGRAM

CAUTION

The scientific notation convention is used by the TROLL computer programs that produced the data in all Appendixes. Number values are shown to the power of 10, e.g., E+07, E+09, (7.501234E+08 is read as $750,123,400). Actual and 1967 constant dollar values are used.

For each regression analysis, the following statistics are generated:

NOB is the number of observations (30 for the entire period 1950-1979).

NOVAR is the number of coefficients to be determined $\sum_{i=1}^{n} (a_i)$ = NOVAR.

Range is the years of data used.

RSQ is the square of the coefficient of correlation (i.e., the coefficient determination)

CSRQ is the adjusted value of the coefficient of determination.

SER is the standard error of the regression [i.e., $\sqrt{SSR/(NOB - NOVAR)}$].

SSR is the sum of the squares of the differences (or residuals) between the actual values observed (LHS) and the values forecast by the test equation (RHS).

F(a/b) is the F test which measures how well the test equation fits the data.

DW(Ø) is the Durbin-Watson statistic which tests whether an autocorrelation of one-time lag is present in the residuals. If the DW range is between 1.5 and 2.5, no autocorrelation exists.

ST ER is the standard error in the values of the equation coefficient as developed by the regression.

T-STAT is the number of times the standard error in the values of the equation coefficients as determined by the regression can be divided into that value.

LHS is the left hand side or actual data observed.

RHS is the right hand side or computed data developed.

RESIDUAL is the difference between the actual data (LHS) and the computed data (RHS).

The Hoerl's Special Function (an exponential-logarithmic form of projection equation) was used in three iterations to forecast 30-year time series of sales data. The iterations were selected on the basis of curve fits and the form of exponential buildup and decay. The second iteration was used to forecast the period 1980-1989 on the assumption that the behavior of the decay phase (1961-1969) will repeat. The three iterations are shown on pages A-4 (1951-1960), A-5 (1961-1969), and A-6 (1970-1979).

- Page A-7 shows the actual and forecast values provided by this triple iteration.
- Page A-8 is the plot of actual and forecast values provided by this triple iteration.

The cumulation of sales experience was also used to estimate the 30-year time series of sales data. Two iterations were used.

- Page A-9 regresses the complete cycle from 1950-1972.
- Page A-10 plots the sales forecast from the regression against the actual sales from 1950-1972.
- Page A-11 regresses the partial cycle from 1973-1979.
- Page A-12 plots the sales forecast from the regression against the actual sales from 1973-1979.
- Page A-13 plots all forecast sales against all actual sales for the 30-year period.

These tests indicate a wide range of model applicability and confirm a cycle of 20-23 years' duration.

2: LOGSALES = A1+A2*LTIM+A3*TIM

NOB = 10 NOVAR = 3
RANGE = 1951 TO 1960
RSQ = 0.73862 CRSQ = 0.66394 F(2/7) = 9.891.
SER = 0.2104 SSR = 0.310 DW(0) = 2.72

COEF	VALUE	ST ER	T-STAT
A1	15.51620	0.16249	95.48990
A2	-0.66861	0.31153	-2.14620
A3	0.06383	0.07543	0.84624

DATE	LHS	RHS	RESIDUAL
1951	15.4416	15.58	-0.138446
1952	15.4933	15.1804	0.312874
1953	14.9383	14.9732	-0.034855
1954	14.8323	14.8446	-0.012335
1955	14.4789	14.7593	-0.280367
1956	14.8571	14.7012	0.155907
1957	14.7438	14.662	0.081846
1958	14.3794	14.6365	-0.257101
1959	14.7294	14.6216	0.107821
1960	14.6796	14.615	0.064639

FRHS1 - DATE REVISED: 7/22/80

ANNUAL DATA FROM 1951 TO 1960
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 2
IN MODEL FCAST1

DATA
1951 15.58 15.1804 14.9732 14.8446
1955 14.7593 14.7012 14.662 14.6365
1959 14.6216 14.615

2: LOGSALES = A1+A2*LTIM+A3*TIM

NOB = 9 NOVAR = 3
RANGE = 1961 TO 1969
RSQ = 0.86353 CRSQ = 0.81804 F(2/6) = 18.983
SER = 0.0918 SSR = 5.058E-02 DW(0) = 1.83

COEF	VALUE	ST ER	T-STAT
A1	-0.04852	3.78325	-0.01282
A2	9.22527	2.25653	4.08825
A3	-0.68080	0.15362	-4.43159

DATE	LHS	RHS	RESIDUAL
1961	14.6763	14.5839	0.09243
1962	14.5905	14.7058	-0.115272
1963	14.7081	14.7634	-0.055288
1964	14.7323	14.7663	-0.033957
1965	14.8496	14.7219	0.127671
1966	14.7018	14.6365	0.065291
1967	14.4659	14.515	-0.049088
1968	14.3226	14.3615	-0.038883
1969	14.1867	14.1795	0.007224

FRHS2 - DATE REVISED: 7/22/80

ANNUAL DATA FROM 1961 TO 1969
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 2
IN MODEL FCAST1

DATA				
1961	14.5839	14.7058	14.7634	14.7663
1965	14.7219	14.6365	14.515	14.3615
1969	14.1795			

2: LOGSALES = A1+A2*LTIM+A3*TIM

NOB = 10 NOVAR = 3
RANGE = 1970 TO 1979
RSQ = 0.89954 CRSQ = 0.87083 F(2/7) = 31.339
SER = 0.2484 SSR = 0.432 DW(0) = 1.58

COEF	VALUE	ST ER	T-STAT
A1	-124.11000	27.79420	-4.46532
A2	61.94200	12.72580	4.86743
A3	-2.37843	0.52443	-4.53524

DATE	LHS	RHS	RESIDUAL
1970	14.0563	13.8831	0.173167
1971	14.3721	14.5269	-0.154756
1972	14.8411	15.03	-0.188869
1973	15.2985	15.405	-0.106483
1974	15.8316	15.6628	0.168835
1975	16.1319	15.8129	0.31897
1976	15.9955	15.8639	0.131577
1977	15.421	15.8232	-0.402166
1978	15.6277	15.6974	-0.069703
1979	15.6221	15.4926	0.129485

NAME: .frhs3;
DEDIT COMMAND: .print all;
FRHS3 - DATE REVISED: 7/22/80

ANNUAL DATA FROM 1970 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 2
IN MODEL FCAST1

DATA

1970	13.8831	14.5269	15.03	15.405
1974	15.6628	15.8129	15.8639	15.8232
1978	15.6974	15.4926		

FRHS - DATE REVISED: 7/22/80

ANNUAL DATA FROM 1951 TO 1979

COMMENT:
FRHS = COMBINE(FRHS1,FRHS2,FRHS3)

DATA

1951	15.58	15.1804	14.9732	14.8446
1955	14.7593	14.7012	14.662	14.6365
1959	14.6216	14.615	14.5839	14.7058
1963	14.7634	14.7663	14.7219	14.6365
1967	14.515	14.3615	14.1795	13.8831
1971	14.5269	15.03	15.405	15.6628
1975	15.8129	15.8639	15.8232	15.6974
1979	15.4926			

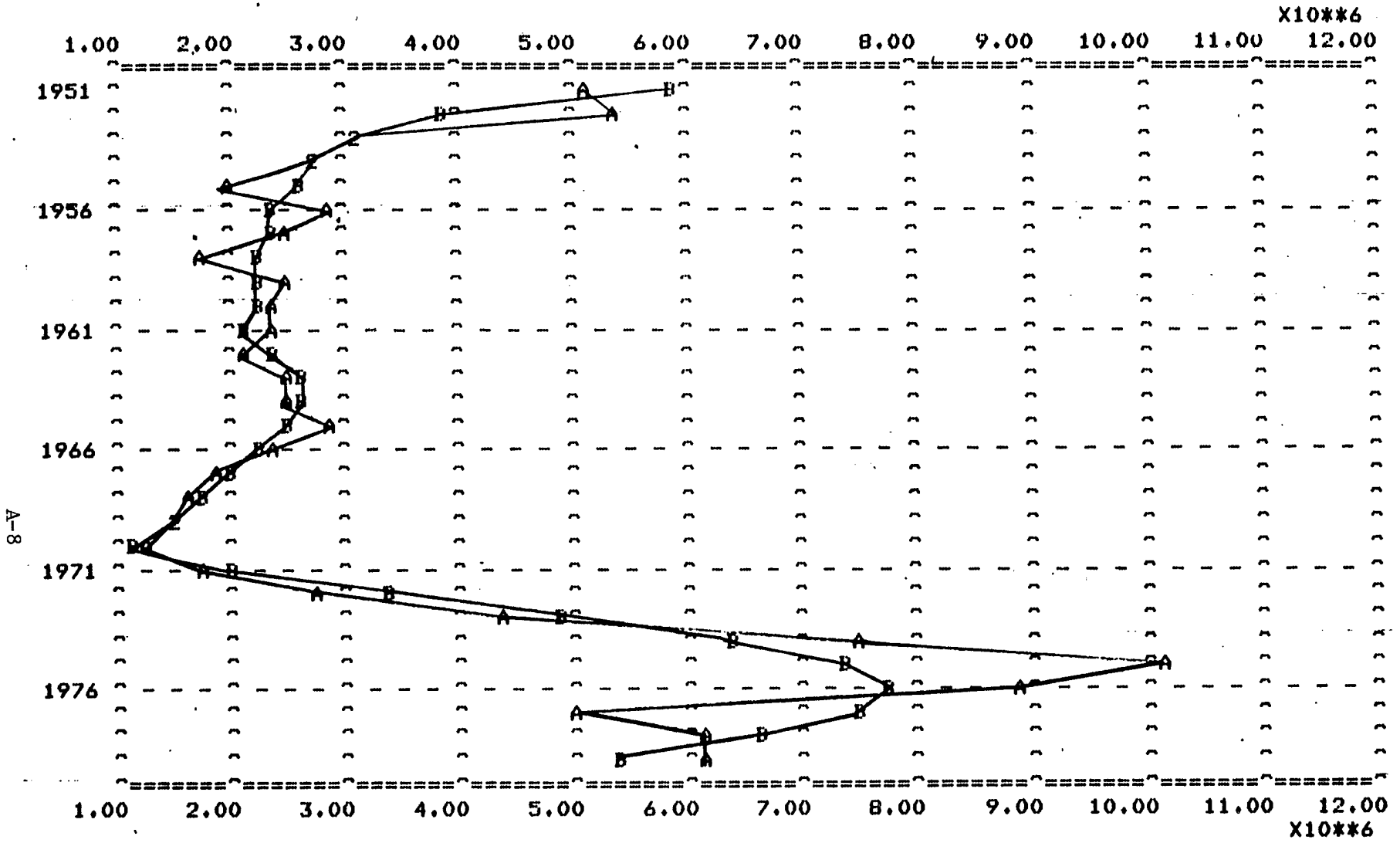
FCASTRHS - DATE REVISED: 7/22/80

ANNUAL DATA FROM 1951 TO 1979

COMMENT:
FCASTRHS = EXP(FRHS)

DATA

1951	5.838857E+06	3.915394E+06	3.182428E+06	2.798614E+06
1955	2.569616E+06	2.424638E+06	2.331340E+06	2.272750E+06
1959	2.239086E+06	2.224317E+06	2.156226E+06	2.435765E+06
1963	2.580229E+06	2.587639E+06	2.475440E+06	2.272768E+06
1967	2.012701E+06	1.726287E+06	1.439024E+06	1.069961E+06
1971	2.036729E+06	3.368467E+06	4.901165E+06	6.342385E+06
1975	7.369993E+06	7.755572E+06	7.445839E+06	6.565918E+06
1979	5.350041E+06			



**********LEGEND**********

TIME BOUNDS: 1951 TO 1979

SYMBOL	SCALE	NAME
A	#1	ALL1
B	#1	FCASTRHS

1: SALCYC1 = A1+A2*TIM

NOB = 23 NOVAR = 2
RANGE = 1950 TO 1972
RSQ = 0.98819 CRSQ = 0.98762 F(1/21) = 1756.420
SER = 1.81E+09 SSR = 6.863E+19 DW(0) = 0.31

COEF	VALUE	ST ER	T-STAT
A1	4.70927E+09	7.79184E+08	6.04384
A2	2.38164E+09	5.68279E+07	41.90960

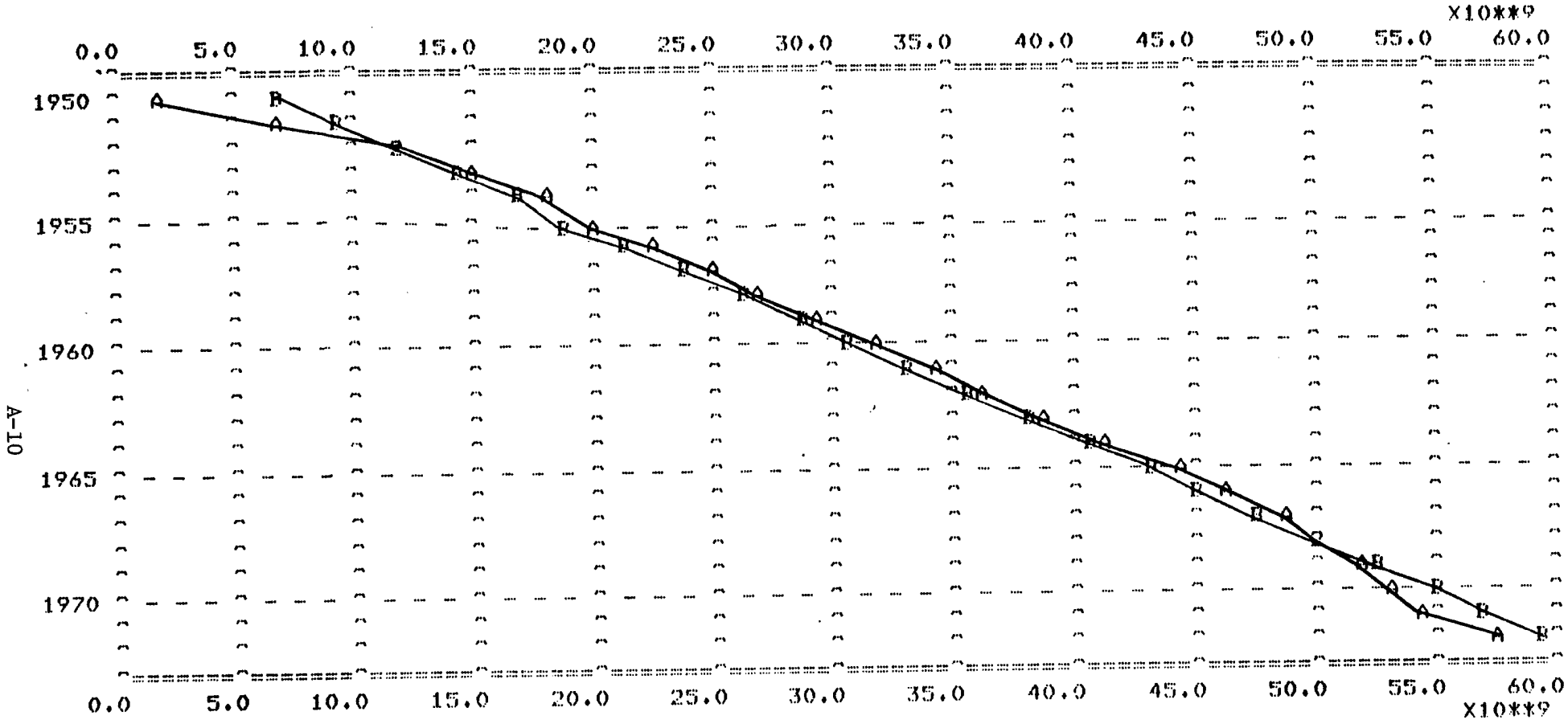
DATE	LHS	RHS	RESIDUAL
1950	1.619700E+09	7.090897E+09	-5.471195E+09
1951	6.703698E+09	9.472532E+09	-2.768835E+09
1952	1.205760E+10	1.185417E+10	2.034319E+08
1953	1.507350E+10	1.423580E+10	8.376934E+08
1954	1.789528E+10	1.661744E+10	1.277837E+09
1955	1.983669E+10	1.899907E+10	8.376115E+08
1956	2.267050E+10	2.138071E+10	-1.289785E+09
1957	2.520059E+10	2.376235E+10	-1.438245E+09
1958	2.695798E+10	2.614398E+10	-8.140022E+08
1959	2.945198E+10	2.852562E+10	-9.263636E+08
1960	3.182490E+10	3.090725E+10	-9.176433E+08
1961	3.419779E+10	3.328889E+10	-9.089024E+08
1962	3.636829E+10	3.567052E+10	-6.977618E+08
1963	3.880979E+10	3.805216E+10	-7.576289E+08
1964	4.131108E+10	4.043380E+10	-8.772895E+08
1965	4.412358E+10	4.281543E+10	-1.308152E+09
1966	4.654969E+10	4.519706E+10	-1.352630E+09
1967	4.846608E+10	4.757870E+10	-8.873820E+08
1968	5.012659E+10	4.996033E+10	-1.662566E+08
1969	5.157600E+10	5.234197E+10	-7.659725E+08
1970	5.284829E+10	5.472360E+10	-1.875317E+09
1971	5.459309E+10	5.710524E+10	-2.512155E+09
1972	5.738179E+10	5.948688E+10	-2.105086E+09

SCYCRHS1 - DATE REVISED: 8/20/80

ANNUAL DATA FROM 1950 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 1
IN MODEL SALCYC

DATA

1950	7.090897E+09	9.472532E+09	1.185417E+10	1.423580E+10
1954	1.661744E+10	1.899907E+10	2.138071E+10	2.376235E+10
1958	2.614398E+10	2.852562E+10	3.090725E+10	3.328889E+10
1962	3.567052E+10	3.805216E+10	4.043380E+10	4.281543E+10
1966	4.519706E+10	4.757870E+10	4.996033E+10	5.234197E+10
1970	5.472360E+10	5.710524E+10	5.948688E+10	



**********LEGEND**********

TIME BOUNDS: 1950 TO 1972

SYMBOL	SCALE	NAME
A	#1	SALCYC1
B	#1	SCYCRHS1

2: SALCYC2 = B1+B2*TIMPD

NOB = 7 NOVAR = 2
RANGE = 1973 TO 1979
RSQ = 0.98739 CRSQ = 0.98487 F(1/5) = 391.509
SER = 1.96E+09 SSR = 1.918E+19 DW(0) = 0.98

COEF	VALUE	ST ER	T-STAT
B1	-1.40198E+09	1.65534E+09	-0.84694
B2	7.32391E+09	3.70145E+08	19.78660

DATE	LHS	RHS	RESIDUAL
1973	4.406100E+09	5.921931E+09	-1.515831E+09
1974	1.191500E+10	1.324584E+10	-1.330844E+09
1975	2.205438E+10	2.056975E+10	1.484632E+09
1976	3.090069E+10	2.789366E+10	3.007025E+09
1977	3.588089E+10	3.521757E+10	6.633226E+08
1978	4.200449E+10	4.254148E+10	-5.369897E+08
1979	4.809409E+10	4.986539E+10	-1.771299E+09

SCYCRHS2 - DATE REVISED: 8/20/80

ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 2
IN MODEL SALCYC

DATA

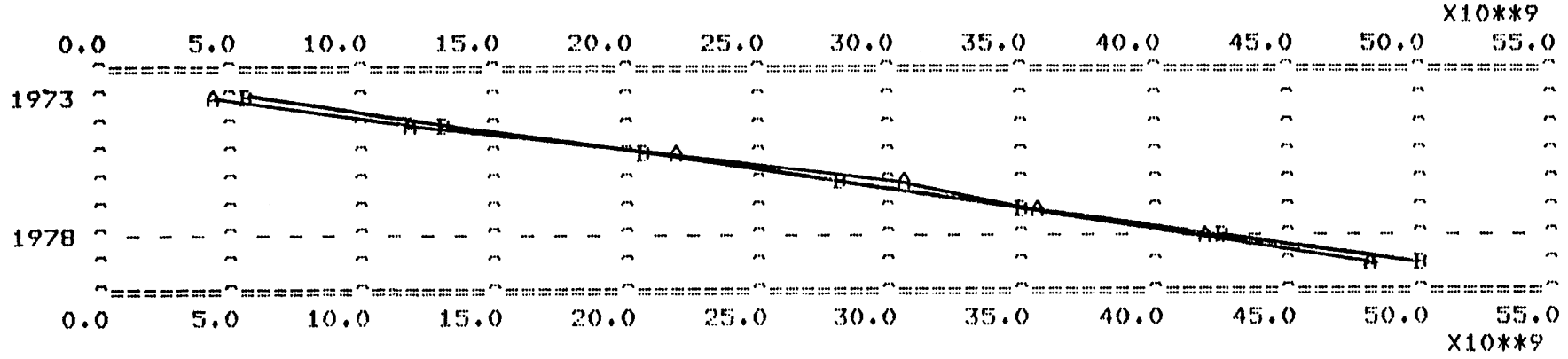
1973	5.921931E+09	1.324584E+10	2.056975E+10	2.789366E+10
1977	3.521757E+10	4.254148E+10	4.986539E+10	

SALPCT2 - DATE REVISED: 8/20/80

ANNUAL DATA FROM 1973 TO 1979
COMMENT:
SALPCT2 = SALPCT2*100

DATA

1973	-34.403	-11.1695	6.73168	9.73125
1977	1.84868	-1.27841	-3.68299	

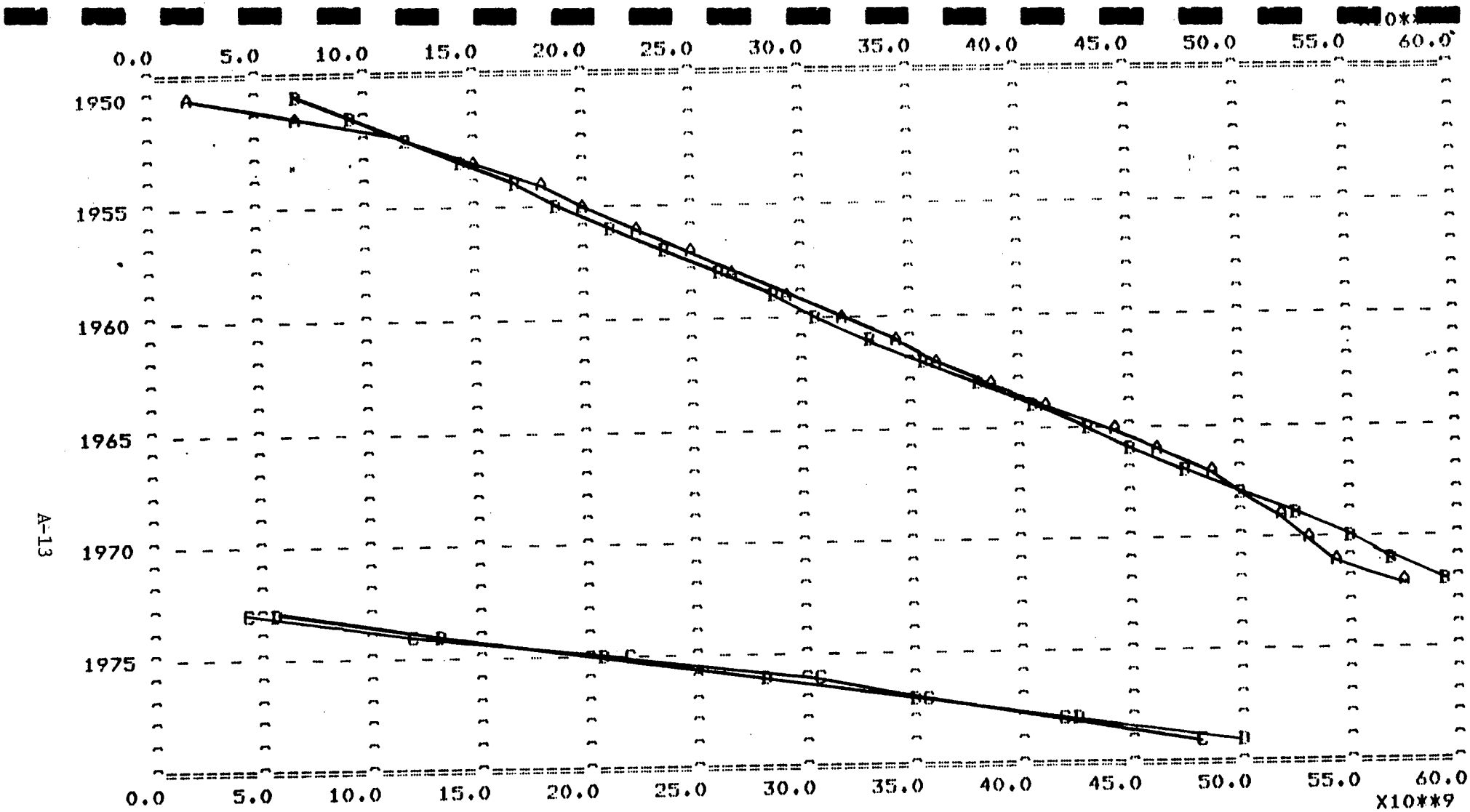


**********LEGEND**********

TIME BOUNDS: 1973 TO 1979

SYMBOL	SCALE	NAME
A	#1	SALCYC2
B	#1	SCYCRHS2

****



**********LEGEND**********

TIME BOUNDS: 1950 TO 1979

SYMBOL	SCALE	NAME
A	#1	SALCYC1
B	#1	SCYCRHS1
C	#1	SALCYC2
D	#1	SCYCRHS2

APPENDIX B

REGRESSION ANALYSIS OF COUNTRY GROUP SALES PROGRAMS

For each regression analysis, the following statistics are generated:

NOB is the number of observations (30 for the entire period 1950-1979).

NOVAR is the number of coefficients to be determined $\sum_{i=1}^{n} (a_i) = \text{NOVAR}$.

Range is the years of data used.

RSQ is the square of the coefficient of correlation (i.e., the coefficient determination)

CSRQ is the adjusted value of the coefficient of determination.

SER is the standard error of the regression [i.e., $\sqrt{\text{SSR}/(\text{NOB} - \text{NOVAR})}$].

SSR is the sum of the squares of the differences (or residuals) between the actual values observed (LHS) and the values forecast by the test equation (RHS).

F(a/b) is the F test which measures how well the test equation fits the data.

DW(Ø) is the Durbin-Watson statistic which tests whether an autocorrelation of one-time lag is present in the residuals. If the DW range is between 1.5 and 2.5, no autocorrelation exists.

ST ER is the standard error in the values of the equation coefficient as developed by the regression.

T-STAT is the number of times the standard error in the values of the equation coefficients as determined by the regression can be divided into that value.

LHS is the left hand side or actual data observed.

RHS is the right hand side or computed data developed.

RESIDUAL is the difference between the actual data (LHS) and the computed data (RHS).

All country group sales models assume the existence of two cycles in the data: the first cycle begins in 1950 and ends in 1972; the second cycle begins in 1973, runs through the remaining period of data (1979) and continues through 1995.

The first cycle (1950-1972) was tested using data from 1964-1972. The cumulative plot for the 1950-1972 cycle provided a straight line regression equation, and the partial data were also assumed to fit a straight line. The second cycle (1973-1979) was tested to the limits of the data.

- Page B-5 lists the models tested.
- Pages B-6 and B-7 show the regressions for both time cycles for the Western Europe and NATO country group.
- Page B-8 plots the forecast sales from the regression against the actual sales for this country group.
- Page B-9 describes the relationship between the data of the first cycle and the data of the second cycle. The regression affirms a linear relationship between the two cumulative equations.
- Page B-10 defines the relationship between the regression equation for data of the first cycle and the regression equation for data of the second cycle. The close agreement of regression constants indicates the difference between the use of actual data and surrogate equations to be very small.
- Pages B-11 through B-15 repeat the development of program projection equations for the East Asia and Pacific country group.
- Pages B-16 through B-20 repeat the development of program projection equations for the Near East and South Asia Country group.
- Pages B-21 through B-25 present equations for the Africa country group.

- Pages B-26 through B-31 present equations for the Latin America country group.
- Pages B-32 through B-39 develop the range of forecast error for the total sales data based on the actual data from 1964-1979.
- Page B-32 plots the country group totals to produce a "difference" graph.
- Pages B-33 and B-34 develop data from the entire group of forecast equations which are then plotted on pages B-35 through B-39 to show the levels of forecast error against the actual data.

COEFFICIENT:
A1 A2 A3 B1 B2 B3

EQUATIONS

1: EURSUM1 = A1+A2*TIM

2: EURSUM2 = B1+B2*TIMPD

3: EURSUM22 = A3+B3*EURSUM1

4: EURF22 = B1+B2*EURF1

5: EAPSUM1 = A1+A2*TIM

6: EAPSUM2 = B1+B2*TIMPD

7: EAPSUM22 = A3+B3*EAPSUM1

8: EAPF22 = B1+B2*EAPF1

9: NEASUM1 = A1+A2*TIM

10: NEASUM2 = B1+B2*TIMPD

11: NEASUM22 = A3+B3*NEASUM1

12: NEAF22 = B1+B2*NEAF1

13: AFRSUM1 = A1+A2*TIM

14: AFRSUM2 = B1+B2*TIMPD

15: AFRSUM22 = A3+B3*AFRSUM1

16: AFRF22 = B1+B2*AFRF1

17: LASUM1 = A1+A2*TIM

18: LASUM2 = B1+B2*TIMPD

19: LASUM22 = A3+B3*LASUM1

20: LAF22 = B1+B2*LAF1

```
EURSUM1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
EURSUM1 = CUMSUM(SAF1)

    DATA
      1964        1.532640E+09  2.421506E+09  3.804849E+09  4.558950E+09
      1968        5.203173E+09  5.897290E+09  6.477324E+09  6.961361E+09
      1972        8.069894E+09


1:  EURSUM1 = A1+A2*TIM


NOB = 9      NOVAR = 2
RANGE =  1964 TO 1972
RSQ =    0.98277      CRSQ =    0.9803      F(1/7) =    399.164
SER = 3.00E+08        SSR = 6.307E+17       DW(0) =  1.02


COEF          VALUE           ST ER          T-STAT

A1       -9.71787E+09    7.43028E+08      -13.07870
A2        7.74198E+08    3.87506E+07       19.97900


 DATE          LHS             RHS           RESIDUAL

1964        1.532640E+09   1.895092E+09  -3.624522E+08
1965        2.421506E+09   2.669294E+09  -2.477873E+08
1966        3.804849E+09   3.443491E+09   3.613581E+08
1967        4.558950E+09   4.217688E+09   3.412623E+08
1968        5.203173E+09   4.991885E+09   2.112881E+08
1969        5.897290E+09   5.766083E+09   1.312072E+08
1970        6.477324E+09   6.540280E+09  -6.295552E+07
1971        6.961361E+09   7.314477E+09  -3.531162E+08
1972        8.069894E+09   8.088674E+09  -1.878016E+07

EURF1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 1
 IN MODEL SAFCUM

    DATA
      1964        1.895092E+09  2.669294E+09  3.443491E+09  4.217688E+09
      1968        4.991885E+09  5.766083E+09  6.540280E+09  7.314477E+09
      1972        8.088674E+09
```

```
EURSUM2 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
EURSUM2 = CUMSUM(SAF1)

    DATA
      1973        7.033221E+08  1.568415E+09  5.747499E+09  6.774051E+09
      1977        7.874310E+09  8.965575E+09  1.018982E+10


2:  EURSUM2 = B1+B2*TIMPD


NOB = 7      NOVAR = 2
RANGE =  1973 TO 1979
RSQ =   0.94036      CRSQ =   0.92844      F(1/5) =    78.842
SER = 9.66E+08       SSR = 4.664E+18       DW(0) =  1.75

COEF            VALUE           ST ER          T-STAT

B1        -1.50949E+10     2.40081E+09        -6.28742
B2         1.62074E+09     1.82530E+08         8.87930

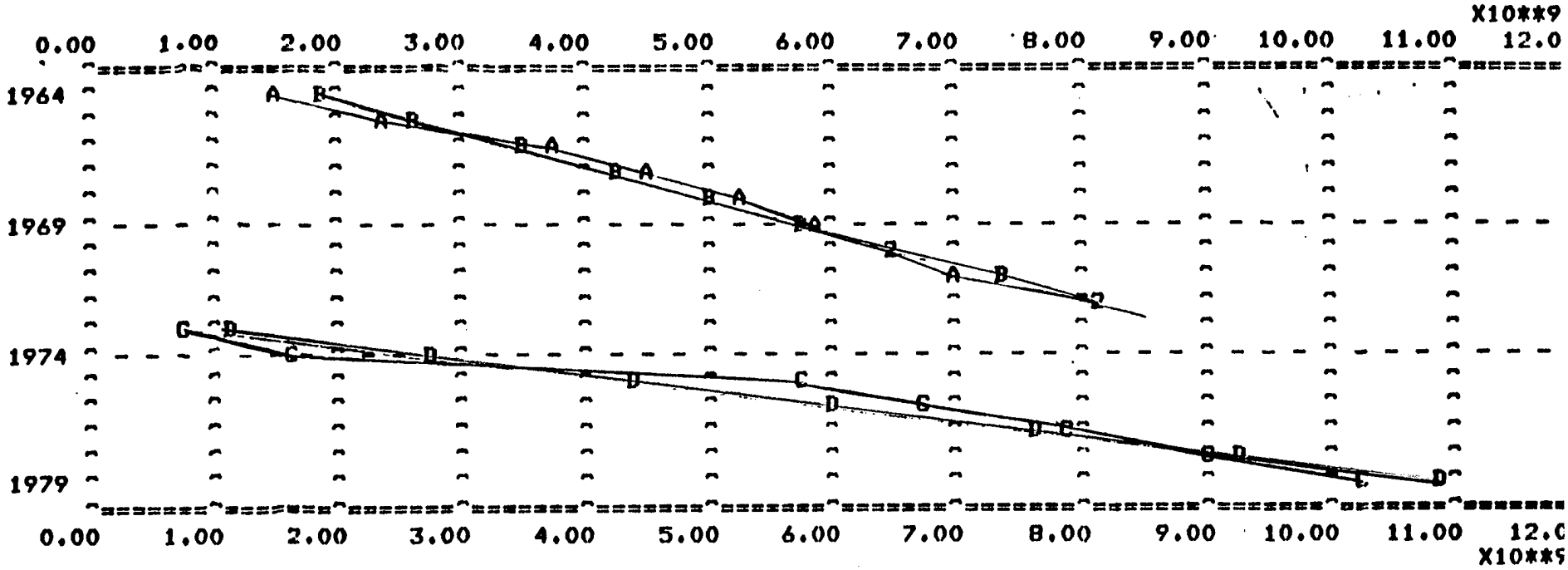

 DATE           LHS             RHS           RESIDUAL

1973         7.033221E+08    1.112502E+09  -4.091802E+08
1974         1.568415E+09    2.733240E+09  -1.164825E+09
1975         5.747499E+09    4.353978E+09   1.393521E+09
1976         6.774051E+09    5.974712E+09   7.993385E+08
1977         7.874310E+09    7.595450E+09   2.788598E+08
1978         8.965575E+09    9.216188E+09  -2.506138E+08
1979         1.018982E+10    1.083693E+10  -6.471025E+08

EURF2 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 2
 IN MODEL SAFCUM

    DATA
      1973        1.112502E+09  2.733240E+09  4.353978E+09  5.974712E+09
      1977        7.595450E+09  9.216188E+09  1.083693E+10
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	EURSUM1
B	#1	EURF1
C	#1	EURSUM2
D	#1	EURF2

****

```
EURSUM1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
EURSUM1 = CUMSUM(SAP1)

    DATA
      1964        1.532640E+09  2.421506E+09  3.804849E+09  4.558950E+09
      1968        5.203173E+09  5.897290E+09  6.477324E+09  6.961361E+09
      1972        8.069894E+09
EURSUM22 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1970
COMMENT:
EURSUM22 = EURSUM2

    DATA
      1964        7.033221E+08  1.568415E+09  5.747499E+09  6.774051E+09
      1968        7.874310E+09  8.965575E+09  1.018982E+10



3:  EURSUM22 = A3+B3*EURSUM1


NOB = 7     NOVAR = 2
RANGE =  1964 TO 1970
RSQ =   0.98476     CRSQ =   0.98171     F(1/5) =   323.044
SER = 4.88E+08      SSR = 1.192E+18      DW(0) =  2.69


COEF          VALUE          ST ER          T-STAT

A3       -2.49131E+09    5.05895E+08      -4.92455
B3            1.98229        0.11029       17.97340


 DATE          LHS            RHS          RESIDUAL

1964       7.033221E+08   5.468337E+08   1.564884E+08
1965       1.568415E+09   2.308826E+09  -7.404109E+08
1966       5.747499E+09   5.051019E+09   6.964797E+08
1967       6.774051E+09   6.545867E+09   2.281841E+08
1968       7.874310E+09   7.822909E+09   5.140070E+07
1969       8.965575E+09   9.198850E+09  -2.332754E+08
1970       1.018982E+10   1.034865E+10  -1.588265E+08

EURF3 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1970
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 3
 IN MODEL SAPCUM

    DATA
      1964        5.468337E+08  2.308826E+09  5.051019E+09  6.545867E+09
      1968        7.822909E+09  9.198850E+09  1.034865E+10
```

```
EURF1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 1
 IN MODEL SAPCUM

    DATA
      1964        1.895092E+09  2.669294E+09  3.443491E+09  4.217688E+09
      1968        4.991885E+09  5.766083E+09  6.540280E+09  7.314477E+09
      1972        8.088674E+09

EURF22 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1970
COMMENT:
EURF22 = EURF2

    DATA
      1964        1.112502E+09  2.733240E+09  4.353978E+09  5.974712E+09
      1968        7.595450E+09  9.216188E+09  1.083693E+10



4:  EURF22 = B1+B2*EURF1


NOB = 7     NOVAR = 2
RANGE =  1964 TO 1970
RSQ =   1.          CRSQ =   1.          F(1/5) =  2.61E+12
SER = 5.31E+03      SSR = 1.410E+08      DW(0) =  0.47

COEF          VALUE          ST ER          T-STAT

B1       -2.85477E+09     5824.71000   -4.90113E+05
B2            2.09344    1.29642E-06    1.61479E+06


 DATE          LHS            RHS          RESIDUAL

1964       1.112502E+09   1.112498E+09     4608.
1965       2.733240E+09   2.733239E+09     1536.
1966       4.353978E+09   4.353974E+09     4096.
1967       5.974712E+09   5.974712E+09        0.
1968       7.595450E+09   7.595446E+09     4096.
1969       9.216188E+09   9.216184E+09     4096.
1970       1.083693E+10   1.083692E+10     8192.

EURF4 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1970
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 4
 IN MODEL SAPCUM

    DATA
      1964        1.112498E+09  2.733239E+09  4.353974E+09  5.974712E+09
      1968        7.595446E+09  9.216184E+09  1.083692E+10
```

```
EAPSUM2 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
EAPSUM2 = CUMSUM(SAP2)

    DATA
      1973        1.539307E+09  4.406845E+09  8.587428E+09  1.346108E+10
      1977        1.547199E+10  1.734796E+10  2.037802E+10


6:  EAPSUM2 = B1+B2*TIMPD


NOB = 7      NOVAR = 2
RANGE =  1973 TO 1979
RSQ =    0.97973      CRSQ =    0.97568      F(1/5) =    241.723
SER = 1.09E+09        SSR = 5.889E+18       DW(0) =  1.20

COEF            VALUE           ST ER          T-STAT

B1        -2.98538E+10     2.69758E+09       -11.06690
B2         3.18868E+09     2.05094E+08        15.54740


 DATE           LHS             RHS           RESIDUAL

1973        1.539307E+09   2.032914E+09  -4.936072E+08
1974        4.406845E+09   5.221589E+09  -8.147436E+08
1975        8.587428E+09   8.410268E+09   1.771602E+08
1976        1.346108E+10   1.159894E+10   1.862140E+09
1977        1.547199E+10   1.478762E+10   6.843720E+08
1978        1.734796E+10   1.797630E+10  -6.283346E+08
1979        2.037802E+10   2.116497E+10  -7.869522E+08

EAPF2 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 6
 IN MODEL SAPCUM

    DATA
      1973        2.032914E+09  5.221589E+09  8.410268E+09  1.159894E+10
      1977        1.478762E+10  1.797630E+10  2.116497E+10
```

```
EAFSUM1 - DATE REVISED:  8/21/80

     ANNUAL DATA FROM 1964 TO 1972
COMMENT:
EAFSUM1 = CUMSUM(SAF2)

     DATA
       1964        1.435694E+08  1.251570E+09  1.459295E+09  1.753350E+09
       1968        2.049809E+09  2.166356E+09  2.353702E+09  2.712709E+09
       1972        3.053782E+09


5:  EAFSUM1 = A1+A2*TIM


NOB = 9      NOVAR = 2
RANGE =  1964 TO 1972
RSQ =    0.9213       CRSQ =    0.91005      F(1/7) =     81.941
SER = 2.60E+08        SSR = 4.730E+17        DW(0) =  1.50

COEF            VALUE            ST ER          T-STAT

A1         -3.88891E+09     6.43458E+08        -6.04377
A2          3.03768E+08     3.35578E+07         9.05209

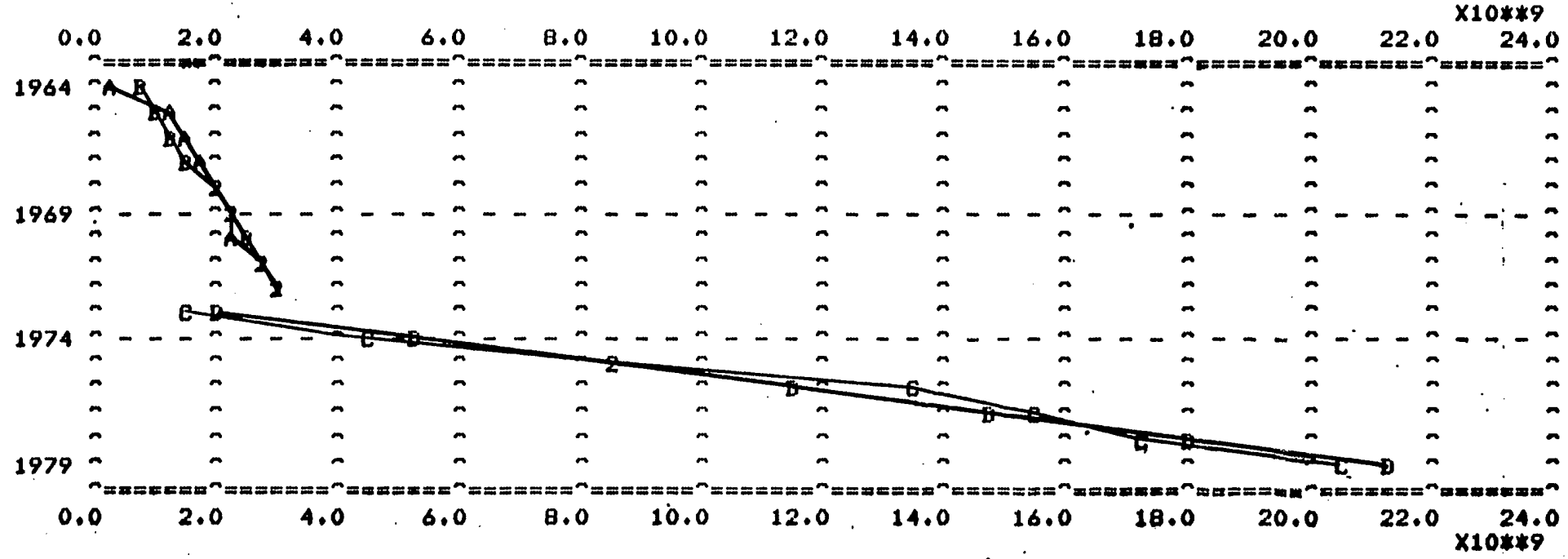

 DATE           LHS              RHS           RESIDUAL

1964         1.435694E+08   6.676065E+08  -5.240371E+08
1965         1.251570E+09   9.713782E+08   2.801923E+08
1966         1.459295E+09   1.275146E+09   1.841498E+08
1967         1.753350E+09   1.578913E+09   1.744369E+08
1968         2.049809E+09   1.882681E+09   1.671278E+08
1969         2.166356E+09   2.186448E+09  -2.009216E+07
1970         2.353702E+09   2.490216E+09  -1.365143E+08
1971         2.712709E+09   2.793983E+09  -8.127437E+07
   2         3.053782E+09   3.097751E+09  -4.396902E+07

EAFF1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 5
 IN MODEL SAFCUM

    DATA
      1964        6.676065E+08  9.713782E+08  1.275146E+09  1.578913E+09
      1968        1.882681E+09  2.186448E+09  2.490216E+09  2.793983E+09
      1972        3.097751E+09
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	EAPSUM1
B	#1	EAPF1
C	#1	EAPSUM2
D	#1	EAPF2

****

```
EAFSUM22 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1970
COMMENT:
EAFSUM22 = EAFSUM2

    DATA
      1964        1.539307E+09  4.406845E+09  8.587428E+09  1.346108E+10
      1968        1.547199E+10  1.734796E+10  2.037802E+10

EAFSUM1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
EAFSUM1 = CUMSUM(SAF2)

    DATA
      1964        1.435694E+08  1.251570E+09  1.459295E+09  1.753350E+09
      1968        2.049809E+09  2.166356E+09  2.353702E+09  2.712709E+09
      1972        3.053782E+09


7:  EAFSUM22 = A3+B3*EAFSUM1


NOB = 7      NOVAR = 2
RANGE =  1964 TO 1970
RSQ =   0.88571      CRSQ =   0.86286      F(1/5) =    38.750
SER = 2.58E+09       SSR = 3.321E+19       DW(0) =  1.81


COEF          VALUE          ST ER          T-STAT

A3       -2.34128E+09    2.44209E+09       -0.95872
B3            8.73007         1.40243        6.22495


 DATE         LHS            RHS           RESIDUAL

1964       1.539307E+09  -1.087908E+09   2.627215E+09
1965       4.406845E+09   8.585011E+09  -4.178166E+09
1966       8.587428E+09   1.039847E+10  -1.811038E+09
1967       1.346108E+10   1.296558E+10   4.955013E+08
1968       1.547199E+10   1.555368E+10  -8.169062E+07
1969       1.734796E+10   1.657115E+10   7.768064E+08
1970       2.037802E+10   1.820669E+10   2.171331E+09


EAFF3 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1970
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 7
 IN MODEL SAFCUM

    DATA
      1964       -1.087908E+09  8.585011E+09  1.039847E+10  1.296558E+10
      1968        1.555368E+10  1.657115E+10  1.820669E+10
```

EAPF22 - DATE REVISED: 8/21/80

ANNUAL DATA FROM 1964 TO 1970
COMMENT:
EAPF22 = EAPF2

DATA

1964	2.032914E+09	5.221589E+09	8.410268E+09	1.159894E+10
1968	1.478762E+10	1.797630E+10	2.116497E+10	

EAPF1 - DATE REVISED: 8/21/80

ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 5
IN MODEL SAPCUM

DATA

1964	6.676065E+08	9.713782E+08	1.275146E+09	1.578913E+09
1968	1.882681E+09	2.186448E+09	2.490216E+09	2.793983E+09
1972	3.097751E+09			

8: EAPF22 = B1+B2*EAPF1

NOB = 7 NOVAR = 2
RANGE = 1964 TO 1970
RSQ = 1. CRSQ = 1. F(1/5) = 1.27E+12
SER = 1.50E+04 SSR = 1.124E+09 DW(0) = 1.57

COEF	VALUE	ST ER	T-STAT
B1	-4.97503E+09	15780.90000	-3.15257E+05
B2	10.49710	9.32806E-06	1.12532E+06

DATE	LHS	RHS	RESIDUAL
1964	2.032914E+09	2.032890E+09	24576.
1965	5.221589E+09	5.221605E+09	-16384.
1966	8.410268E+09	8.410280E+09	-12288.
1967	1.159894E+10	1.159895E+10	-8192.
1968	1.478762E+10	1.478762E+10	-4096.
1969	1.797630E+10	1.797630E+10	0.
1970	2.116497E+10	2.116497E+10	4096.

EAPF4 - DATE REVISED: 8/21/80

ANNUAL DATA FROM 1964 TO 1970
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 8
IN MODEL SAPCUM

DATA

1964	2.032890E+09	5.221605E+09	8.410280E+09	1.159895E+10
1968	1.478762E+10	1.797630E+10	2.116497E+10	

```
NEASUM1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
NEASUM1 = CUMSUM(SAF3)

    DATA
      1964        2.855365E+08  5.172308E+08  8.124570E+08  1.205398E+09
      1968        1.738239E+09  2.044972E+09  2.364571E+09  2.740104E+09
      1972        3.407710E+09

9:  NEASUM1 = A1+A2*TIM


  .. = 9      NOVAR = 2
RANGE =  1964 TO 1972
RSQ =    0.98953      CRSQ =    0.98803      F(1/7) =    661.540
SER = 1.16E+08        SSR = 9.411E+16        DW(0) =  1.53

COEF            VALUE           ST ER          T-STAT

A1         -5.63577E+09     2.87032E+08       -19.63460
A2          3.85019E+08     1.49694E+07        25.72040


 DATE           LHS             RHS            RESIDUAL

1964        2.855365E+08    1.395057E+08    1.460308E+08
 65         5.172308E+08    5.245256E+08   -7.294720E+06
1966        8.124570E+08    9.095414E+08   -9.708442E+07
1967        1.205398E+09    1.294561E+09   -8.916326E+07
1968        1.738239E+09    1.679581E+09    5.865805E+07
1969        2.044972E+09    2.064597E+09   -1.962496E+07
1970        2.364571E+09    2.449617E+09   -8.504576E+07
1971        2.740104E+09    2.834637E+09   -9.453286E+07
1972        3.407710E+09    3.219653E+09    1.880579E+08

NEAF1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 9
 IN MODEL SAPCUM

    DATA
      1964        1.395057E+08  5.245256E+08  9.095414E+08  1.294561E+09
      1968        1.679581E+09  2.064597E+09  2.449617E+09  2.834637E+09
      1972        3.219653E+09
```

NEASUM2 - DATE REVISED: 8/21/80

ANNUAL DATA FROM 1973 TO 1979
COMMENT:
NEASUM2 = CUMSUM(SAF3)

DATA

1973	2.578592E+08	8.932713E+08	1.929120E+09	4.234911E+09
1977	4.831719E+09	7.697641E+09	1.019152E+10	

10: NEASUM2 = B1+B2*TIME

NOB = 7 NOVAR = 2
RANGE = 1973 TO 1979
RSQ = 0.95625 CRSQ = 0.94749 F(1/5) = 109.273
SER = 8.37E+08 SSR = 3.505E+18 DW(0) = 1.47

COEF	VALUE	ST ER	T-STAT
B1	-1.72113E+10	2.08115E+09	-8.27007
B2	1.65401E+09	1.58227E+08	10.45340

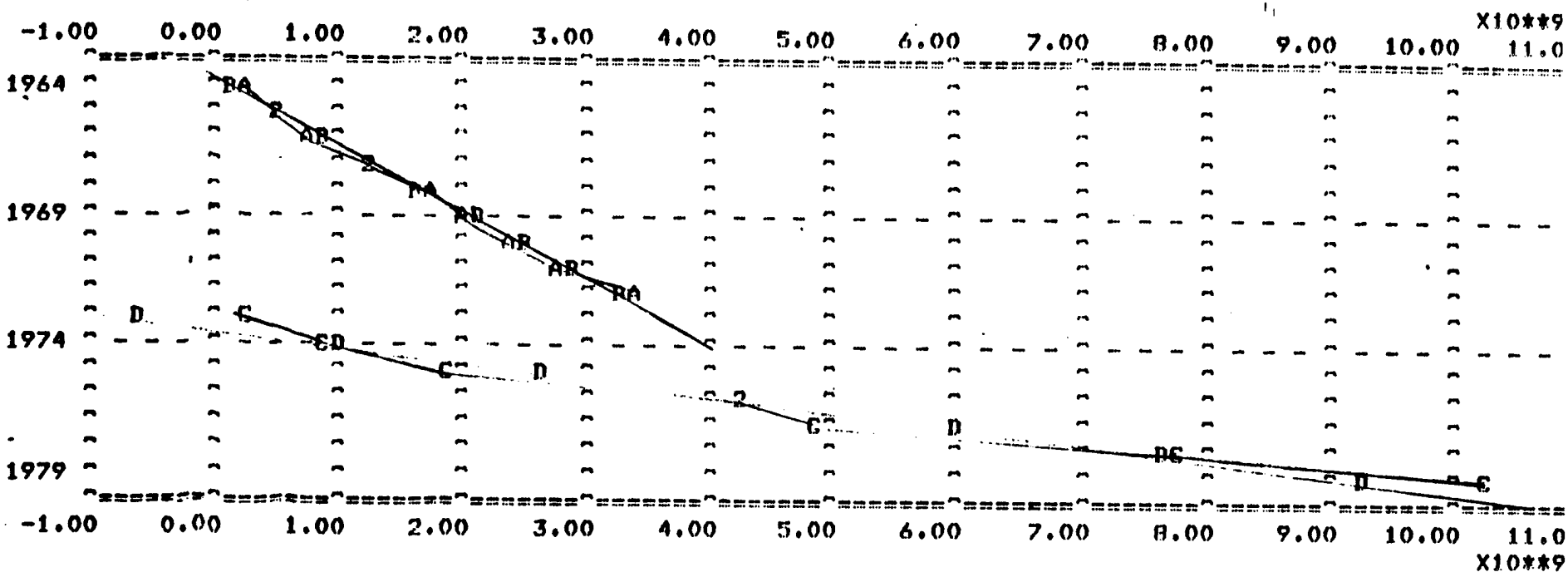
DATE	LHS	RHS	RESIDUAL
1973	2.578592E+08	-6.711706E+08	9.290296E+08
1974	8.932713E+08	9.828393E+08	-8.956800E+07
1975	1.929120E+09	2.636853E+09	-7.077332E+08
1976	4.234911E+09	4.290863E+09	-5.595162E+07
1977	4.831719E+09	5.944877E+09	-1.113158E+09
1978	7.697641E+09	7.598887E+09	9.875456E+07
1979	1.019152E+10	9.252901E+09	9.386230E+08

NEAF2 - DATE REVISED: 8/21/80

ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 10
IN MODEL SAFCUM

DATA

1973	-6.711706E+08	9.828393E+08	2.636853E+09	4.290863E+09
1977	5.944877E+09	7.598887E+09	9.252901E+09	



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	NEASUM1
B	#1	NEAF1
C	#1	NEASUM2
D	#1	NEAF2

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```
   12:       NEAF22 = B1+B2*NEAF1


NEASUM22 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1970
COMMENT:
NEASUM22 = NEASUM2

    DATA
      1964       2.578592E+08  8.932713E+08  1.929120E+09  4.234911E+09
      1968       4.831719E+09  7.697641E+09  1.019152E+10

NEASUM1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
NEASUM1 = CUMSUM(SAF3)

    DATA
      1964       2.855365E+08  5.172308E+08  8.124570E+08  1.205398E+09
      1968       1.738239E+09  2.044972E+09  2.364571E+09  2.740104E+09
      1972       3.407710E+09


11:  NEASUM22 = A3+B3*NEASUM1


NOB = 7     NOVAR = 2
RANGE =  1964 TO 1970
RSQ =   0.95385     CRSQ =   0.94462     F(1/5) =   103.337
SER = 8.60E+08      SSR = 3.697E+18      DW(0) =  1.92


COEF          VALUE          ST ER          T-STAT

A3       -1.47982E+09    6.54128E+08       -2.26228
B3            4.50412         0.44308.      10.16550


 DATE          LHS            RHS          RESIDUAL

1964       2.578592E+08  -1.937290E+08   4.515881E+08
1965       8.932713E+08   8.498506E+08   4.342067E+07
1966       1.929120E+09   2.179585E+09  -2.504650E+08
1967       4.234911E+09   3.949436E+09   2.854753E+08
1968       4.831719E+09   6.349414E+09  -1.517695E+09
1969       7.697641E+09   7.730979E+09  -3.333734E+07
1970       1.019152E+10   9.170489E+09   1.021034E+09


NEAF22 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1970
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 11
 IN MODEL SAFCUM

    DATA
      1964      -1.937290E+08  8.498506E+08  2.179585E+09  3.949436E+09
      1968       6.349414E+09  7.730979E+09  9.170489E+09
```

NEAF1 - DATE REVISED: 8/21/80

ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 9
IN MODEL SAPCUM

DATA				
1964	1.395057E+08	5.245256E+08	9.095414E+08	1.294561E+09
1968	1.679581E+09	2.064597E+09	2.449617E+09	2.834637E+09
1972	3.219653E+09			

12: NEAF22 = B1+B2*NEAF1

= 7 NOVAR = 2
RANGE = 1964 TO 1970
RSQ = 0.9901 CRSQ = 0.98812 F(1/5) = 500.190
SER = 3.89E+08 SSR = 7.562E+17 DW(0) = 1.53

COEF	VALUE	ST ER	T-STAT
B1	-1.23595E+09	2.87532E+08	-4.29847
B2	4.26925	0.19089	22.36490

DATE	LHS	RHS	RESIDUAL
1964	-1.937290E+08	-6.403630E+08	4.466340E+08
1965	8.498506E+08	1.003384E+09	-1.535332E+08
1966	2.179585E+09	2.647113E+09	-4.675282E+08
1967	3.949436E+09	4.290859E+09	-3.414226E+08
1968	6.349414E+09	5.934600E+09	4.148142E+08
1969	7.730979E+09	7.578329E+09	1.526497E+08
1970	9.170489E+09	9.222078E+09	-5.158912E+07

NEAF3 - DATE REVISED: 8/21/80

ANNUAL DATA FROM 1964 TO 1970
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 12
IN MODEL SAPCUM

DATA				
1964	-6.403630E+08	1.003384E+09	2.647113E+09	4.290859E+09
1968	5.934600E+09	7.578329E+09	9.222078E+09	

```
AFRSUM1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
AFRSUM1 = CUMSUM(SAF4)

    DATA
      1964        1.138770E+08  2.380604E+08  3.389665E+08  4.228365E+08
      1968        4.729380E+08  5.458668E+08  5.899077E+08  6.272627E+08
      1972        7.005312E+08

13:  AFRSUM1 = A1+A2*TIM

NOB = 9      NOVAR = 2
RANGE =  1964 TO 1972
RSQ =   0.96977      CRSQ =   0.96545      F(1/7) =   224.555
SER = 3.57E+07       SSR = 8.901E+15       DW(0) =  0.71

COEF            VALUE           ST ER          T-STAT

A1         -8.60699E+08     8.82727E+07       -9.75046
A2          6.89856E+07     4.60362E+06       14.98510


 DATE           LHS             RHS           RESIDUAL

1964        1.138770E+08   1.740851E+08  -6.020810E+07
1965        2.380604E+08   2.430710E+08  -5.010592E+06
1966        3.389665E+08   3.120566E+08   2.690995E+07
1967        4.228365E+08   3.810422E+08   4.179430E+07
1968        4.729380E+08   4.500278E+08   2.291021E+07
1969        5.458668E+08   5.190134E+08   2.685338E+07
1970        5.899077E+08   5.879990E+08   1.908736E+06
1971        6.272627E+08   6.569846E+08  -2.972186E+07
1972        7.005312E+08   7.259702E+08  -2.543898E+07

AFRF1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 13
 IN MODEL SAFCUM

    DATA
      1964        1.740851E+08  2.430710E+08  3.120566E+08  3.810422E+08
      1968        4.500278E+08  5.190134E+08  5.879990E+08  6.569846E+08
      1972        7.259702E+08
```

```
AFRSUM2 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
AFRSUM2 = CUMSUM(SAF4)

    DATA
      1973        1.202752E+08  2.760346E+08  4.337628E+08  4.963348E+08
      1977        5.578066E+08  1.073987E+09  1.133720E+09


14:  AFRSUM2 = B1+B2*TIMPD


NOB = 7      NOVAR = 2
RANGE =  1973 TO 1979
RSQ =   0.91642      CRSQ =   0.89971      F(1/5) =    54.826
SER = 1.21E+08       SSR = 7.381E+16       DW(0) =  2.11

COEF            VALUE           ST ER          T-STAT

B1        -1.62557E+09    3.02000E+08        -5.38269
B2         1.70010E+08    2.29606E+07         7.40442

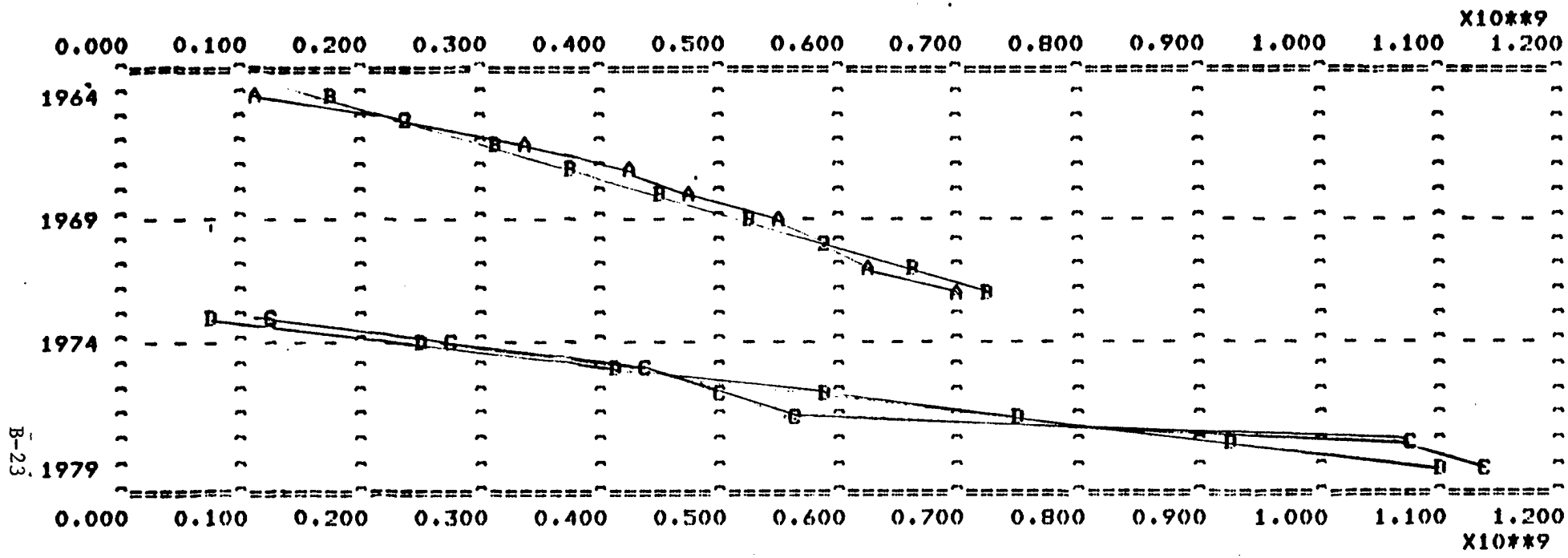

 DATE           LHS             RHS           RESIDUAL

1973        1.202752E+08   7.452979E+07   4.574541E+07
1974        2.760346E+08   2.445396E+08   3.149491E+07
1975        4.337628E+08   4.145498E+08   1.921306E+07
1976        4.963348E+08   5.845599E+08  -8.822502E+07
1977        5.578066E+08   7.545700E+08  -1.967634E+08
1978        1.073987E+09   9.245801E+08   1.494065E+08
1979        1.133720E+09   1.094590E+09   3.912960E+07

AFRF2 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 14
 IN MODEL SAFCUM

    DATA
      1973        7.452979E+07  2.445396E+08  4.145498E+08  5.845599E+08
      1977        7.545700E+08  9.245801E+08  1.094590E+09
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	AFRSUM1
B	#1	AFRF1
C	#1	AFRSUM2
D	#1	AFRF2

****

```
AFRSUM22 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1970
COMMENT:
AFRSUM22 = AFRSUM2

    DATA
      1964        1.202752E+08  2.760346E+08  4.337628E+08  4.963348E+08
      1968        5.578066E+08  1.073987E+09  1.133720E+09

AFRSUM1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
AFRSUM1 = CUMSUM(SAF4)

    DATA
      1964        1.138770E+08  2.380604E+08  3.389665E+08  4.228365E+08
      1968        4.729380E+08  5.458668E+08  5.899077E+08  6.272627E+08
      1972        7.005312E+08


15:  AFRSUM22 = A3+B3*AFRSUM1


NOB = 7      NOVAR = 2
RANGE =  1964 TO 1970
RSQ =    0.86027      CRSQ =    0.83232      F(1/5) =     30.782
SER = 1.57E+08        SSR = 1.234E+17       DW(0) =  1.31

COEF          VALUE          ST ER          T-STAT

A3       -2.27773E+08   1.57997E+08       -1.44163
B3            2.08868        0.37646        5.54814


 DATE          LHS            RHS          RESIDUAL

1964       1.202752E+08   1.007934E+07   1.101959E+08
1965       2.760346E+08   2.694582E+08   6.576384E+06
1966       4.337628E+08   4.802189E+08  -4.645606E+07
1967       4.963348E+08   6.553964E+08  -1.590615E+08
1968       5.578066E+08   7.600422E+08  -2.022356E+08
1969       1.073987E+09   9.123671E+08   1.616195E+08
1970       1.133720E+09   1.004355E+09   1.293652E+08


AFRF3 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1970
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 15
 IN MODEL SAPCUM

    DATA
      1964        1.007934E+07  2.694582E+08  4.802189E+08  6.553964E+08
      1968        7.600422E+08  9.123671E+08  1.004355E+09
```

```
AFRF22 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1970
COMMENT:
AFRF22 = AFRF2

    DATA
      1964        7.452979E+07  2.445396E+08  4.145498E+08  5.845599E+08
      1968        7.545700E+08  9.245801E+08  1.094590E+09

AFRF1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 13
 IN MODEL SAFCUM

    DATA
      1964        1.740851E+08  2.430710E+08  3.120566E+08  3.810422E+08
      1968        4.500278E+08  5.190134E+08  5.879990E+08  6.569846E+08
      1972        7.259702E+08



16:  AFRF22 = B1+B2*AFRF1


NOB = 7     NOVAR = 2
RANGE =  1964 TO 1970
RSQ =   1.          CRSQ =   1.          F(1/5) =  1.03E+13
SER = 280.4340      SSR = 3.932E+05      DW(0) =  1.67


COEF          VALUE          ST ER          T-STAT

B1       -3.54491E+08       311.32800   -1.13864E+06
B2            2.46443    7.68233E-07    3.20792E+06


 DATE          LHS            RHS          RESIDUAL

1964        7.452979E+07   7.452928E+07      512.
1965        2.445396E+08   2.445399E+08     -256.
1966        4.145498E+08   4.145500E+08     -256.
1967        5.845599E+08   5.845599E+08        0.
1968        7.545700E+08   7.545700E+08        0.
1969        9.245801E+08   9.245801E+08        0.
1970        1.094590E+09   1.094590E+09        0.
```

LASUM1 - DATE REVISED: 8/21/80

ANNUAL DATA FROM 1964 TO 1972
COMMENT:
LASUM1 = CUMSUM(SAF5)

DATA

1964	1.423712E+07	2.991290E+07	4.755526E+07	6.585411E+07
1968	7.748005E+07	8.907579E+07	9.860790E+07	1.211654E+08
1972	1.309213E+08			

17: LASUM1 = A1+A2*TIM

NOB = 9 NOVAR = 2
RANGE = 1964 TO 1972
RSQ = 0.99302 CRSQ = 0.99203 F(1/7) = 996.401
SER = 3.54E+06 SSR = 8.777E+13 DW(0) = 1.76

COEF	VALUE	ST ER	T-STAT
A1	-1.99198E+08	8.76571E+06	-22.72470
A2	1.44304E+07	4.57151E+05	31.56580

DATE	LHS	RHS	RESIDUAL
1964	1.423712E+07	1.725750E+07	-3.020384E+06
1965	2.991290E+07	3.168787E+07	-1.774976E+06
1966	4.755526E+07	4.611822E+07	1.437040E+06
1967	6.585411E+07	6.054858E+07	5.305536E+06
1968	7.748005E+07	7.497870E+07	2.501344E+06
1969	8.907579E+07	8.940917E+07	-333376.
1970	9.860790E+07	1.038396E+08	-5.231728E+06
1971	1.211654E+08	1.182698E+08	2.895520E+06
1972	1.309213E+08	1.327003E+08	-1.778992E+06

LAF1 - DATE REVISED: 8/21/80

ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 17
IN MODEL SAFCUM

DATA

1964	1.725750E+07	3.168787E+07	4.611822E+07	6.054858E+07
1968	7.497870E+07	8.940917E+07	1.038396E+08	1.182698E+08
1972	1.327003E+08			

```
LASUM2 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
LASUM2 = CUMSUM(SAP5)

    DATA
      1973        8.511249E+06  2.341086E+07  4.295934E+07  1.404744E+08
      1977        2.014470E+08  3.375473E+08  3.863767E+08


18:  LASUM2 = B1+B2*TIMPD


NOB = 7      NOVAR = 2
RANGE =  1973 TO 1979
RSQ =    0.94001      CRSQ =    0.92801      F(1/5) =     78.349
SER = 4.10E+07        SSR = 8.405E+15       DW(0) =  1.32

COEF            VALUE           ST ER          T-STAT

B1         -7.28633E+08     1.01913E+08       -7.14957
B2          6.85842E+07     7.74829E+06        8.85152

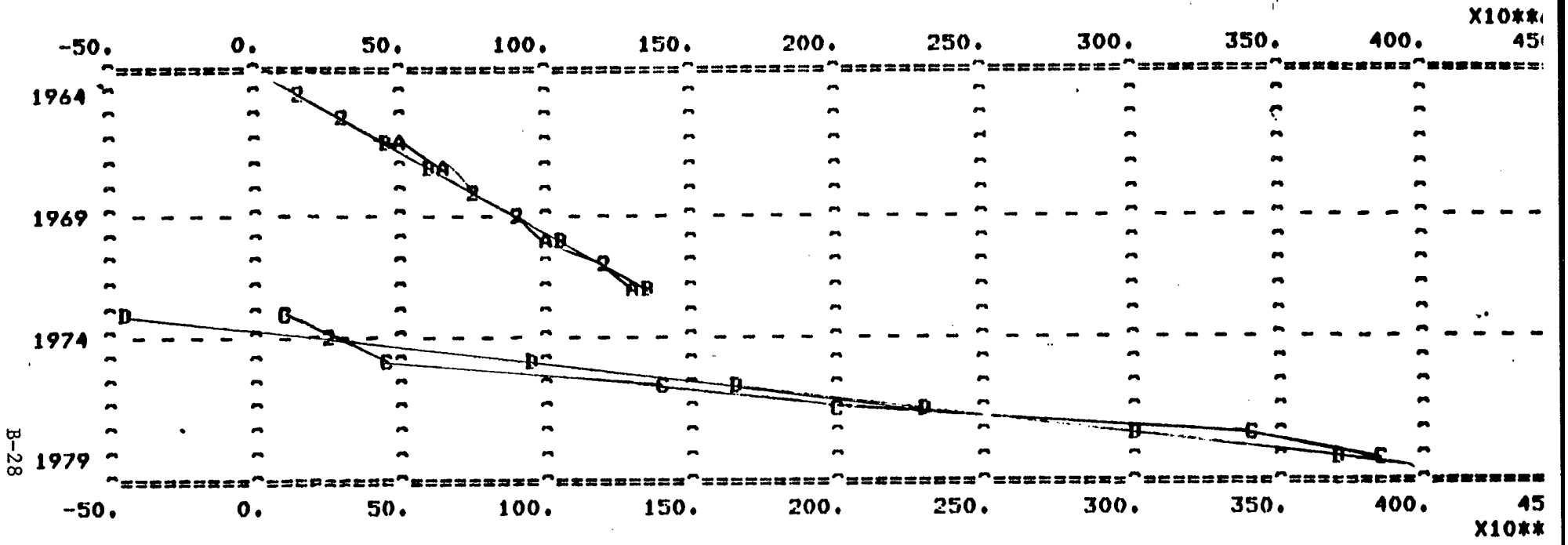

 DATE           LHS             RHS           RESIDUAL

1973        8.511249E+06  -4.279194E+07   5.130318E+07
1974        2.341086E+07   2.579226E+07  -2.381392E+06
1975        4.295934E+07   9.437645E+07  -5.141710E+07
1976        1.404744E+08   1.629606E+08  -2.248627E+07
1977        2.014470E+08   2.315448E+08  -3.009786E+07
1978        3.375473E+08   3.001290E+08   3.741824E+07
1979        3.863767E+08   3.687132E+08   1.766349E+07

LAF2 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 18
 IN MODEL SAPCUM

    DATA
      1973       -4.279194E+07  2.579226E+07  9.437645E+07  1.629606E+08
      1977        2.315448E+08  3.001290E+08  3.687132E+08
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	LASUM1
B	#1	LAF1
C	#1	LASUM2
D	#1	LAF2

****

```
   ANNUAL DATA FROM 1964 TO 1970
COMMENT:
LASUM22 = LASUM2

   DATA
     1964        8.511249E+06  2.341086E+07  4.295934E+07  1.404744E+08
     1968        2.014470E+08  3.375473E+08  3.863767E+08

LASUM1 - DATE REVISED:  8/21/80

   ANNUAL DATA FROM 1964 TO 1972
COMMENT:
LASUM1 = CUMSUM(SAP5)

   DATA
     1964        1.423712E+07  2.991290E+07  4.755526E+07  6.585411E+07
     1968        7.748005E+07  8.907579E+07  9.860790E+07  1.211654E+08
     1972        1.309213E+08


19:  LASUM22 = A3+B3*LASUM1


NOB = 7      NOVAR = 2
RANGE =  1964 TO 1970
RSQ =   0.8928       CRSQ =   0.87136      F(1/5) =    41.641
SER = 5.48E+07       SSR = 1.502E+16       DW(0) =  0.95

COEF            VALUE           ST ER          T-STAT

A3        -1.16789E+08     4.80475E+07        -2.43071
B3             4.63247         0.71788         6.45297


 DATE           LHS             RHS           RESIDUAL

1964        8.511249E+06  -5.083642E+07   5.934766E+07
1965        2.341086E+07   2.178117E+07   1.629696E+06
1966        4.295934E+07   1.035089E+08  -6.054960E+07
1967        1.404744E+08   1.882778E+08  -4.780342E+07
1968        2.014470E+08   2.421346E+08  -4.068758E+07
1969        3.375473E+08   2.958515E+08   4.169574E+07
1970        3.863767E+08   3.400087E+08   4.636800E+07


LAF3 - DATE REVISED:  8/21/80

   ANNUAL DATA FROM 1964 TO 1970
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 19
 IN MODEL SAPCUM

   DATA
     1964       -5.083642E+07  2.178117E+07  1.035089E+08  1.882778E+08
     1968        2.421346E+08  2.958515E+08  3.400087E+08
```

```
LAF22 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1970
COMMENT:
LAF22 = LAF2

    DATA
      1964       -4.279194E+07  2.579226E+07  9.437645E+07  1.629606E+08
      1968        2.315448E+08  3.001290E+08  3.687132E+08

LAF1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 17
 IN MODEL SAFCUM

    DATA
      1964        1.725750E+07  3.168787E+07  4.611822E+07  6.054858E+07
      1968        7.497870E+07  8.940917E+07  1.038396E+08  1.182698E+08
      1972        1.327003E+08

LAF22 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1970
COMMENT:
LAF22 = LAF2

    DATA
      1964       -4.279194E+07  2.579226E+07  9.437645E+07  1.629606E+08
      1968        2.315448E+08  3.001290E+08  3.687132E+08
```

LAF1 - DATE REVISED: 8/21/80

ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 17
IN MODEL SAPCUM

DATA

1964	1.725750E+07	3.168787E+07	4.611822E+07	6.054858E+07
1968	7.497870E+07	8.940917E+07	1.038396E+08	1.182698E+08
1972	1.327003E+08			

20: LAF22 = B1+B2*LAF1

NOB = 7 NOVAR = 2
RANGE = 1964 TO 1970
RSQ = 1. CRSQ = 1. F(1/5) = 7.21E+11
SER = 427.3530 SSR = 9.132E+05 DW(0) = 1.08

COEF	VALUE	ST ER	T-STAT
B1	-1.24813E+08	375.39800	-3.32482E+05
B2	4.75278	5.59669E-06	8.49213E+05

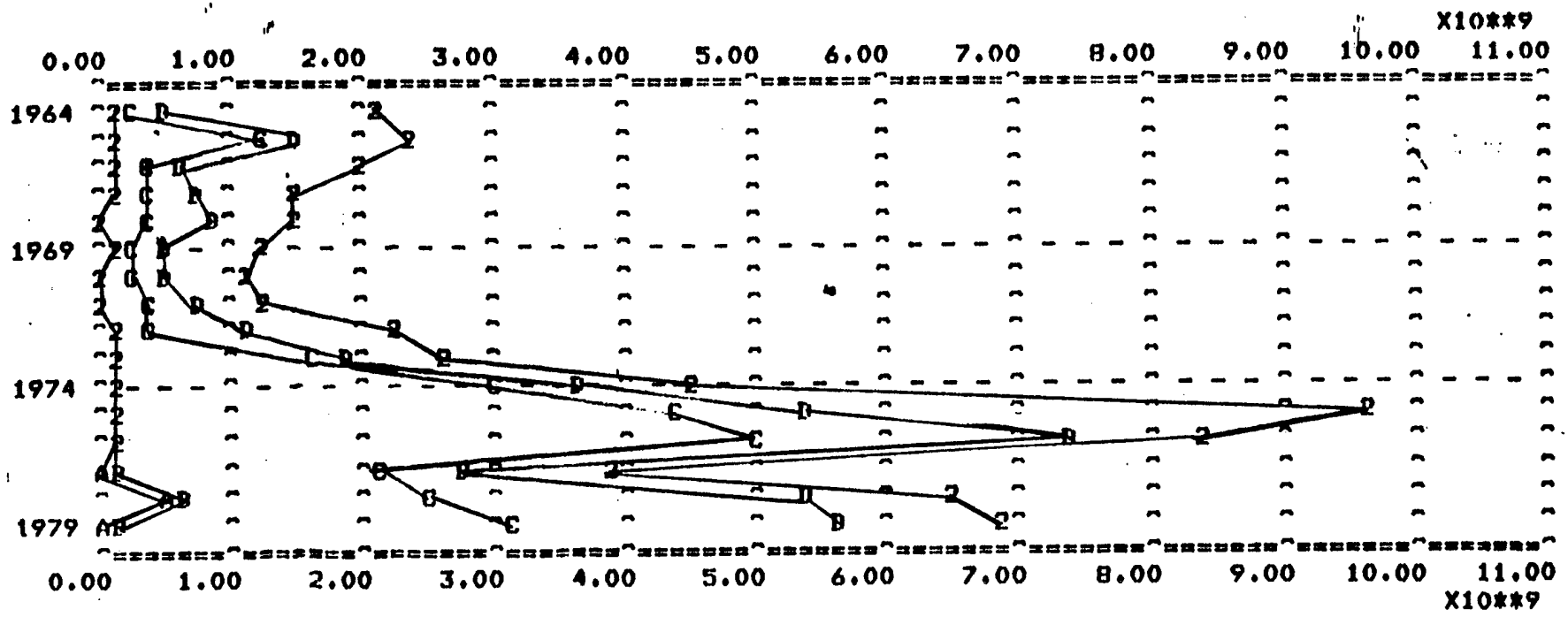
DATE	LHS	RHS	RESIDUAL
1964	-4.279194E+07	-4.279200E+07	64.
1965	2.579226E+07	2.579234E+07	-80.
1966	9.437645E+07	9.437661E+07	-160.
1967	1.629606E+08	1.629606E+08	16.
1968	2.315448E+08	2.315440E+08	784.
1969	3.001290E+08	3.001285E+08	512.
1970	3.687132E+08	3.687132E+08	0.

LAF4 - DATE REVISED: 8/21/80

ANNUAL DATA FROM 1964 TO 1970
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 20
IN MODEL SAPCUM

DATA

1964	-4.279200E+07	2.579234E+07	9.437661E+07	1.629606E+08
1968	2.315440E+08	3.001285E+08	3.687132E+08	



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	S0
B	#1	S1
C	#1	S2
D	#1	S3
E	#1	S4
F	#1	SAPTOTC

****

```
TCUM1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
TCUM1 = TCUM1*1000

    DATA
      1964        2.893577E+09  4.439974E+09  5.986370E+09  7.532765E+09
      1968        9.079165E+09  1.062556E+10  1.217196E+10  1.371636E+10
      1972        1.526475E+10

SAFTF1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
SAFTF1 = EURF1+EAFF1+NEAF1+AFRF1+LAF1

    DATA
      1964        2.893547E+09  4.439953E+09  5.986345E+09  7.532745E+09
      1968        9.079149E+09  1.062554E+10  1.217194E+10  1.371834E+10
      1972        1.526474E+10


FSAF1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
FSAF1 = FSAF1*1000

    DATA
      1964        2.212983E+09  3.686473E+09  5.159948E+09  6.633431E+09
      1968        8.106918E+09  9.580401E+09  1.105389E+10  1.252737E+10
      1972        1.400086E+10


SAFTCUM1 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
SAFTCUM1 = EURSUM1+EAFSUM1+NEASUM1+AFRSUM1+LASUM1

    DATA
      1964        2.089860E+09  4.458275E+09  6.463115E+09  8.006382E+09
      1968        9.541632E+09  1.074355E+10  1.188411E+10  1.316259E+10
      1972        1.536283E+10
```

```
TCUM2 = TCUM2*1000

    DATA
      1973        2.505982E+09  9.207992E+09  1.591001E+10  2.261201E+10
      1977        2.931403E+10  3.601605E+10  4.271804E+10


TCUM3 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1964 TO 1970
COMMENT:
TCUM3 = EURF3+EAPF3+NEAF3+AFRF3+LAF3

    DATA
      1964       -1.222194E+09  1.218845E+10  1.868032E+10  2.464597E+10
      1968        3.031337E+10  3.455655E+10  3.912178E+10

SAPTF2 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
SAPTF2 = EURF22+EAPF22+NEAF22+AFRF22+LAF22

    DATA
      1973        2.983426E+09  9.075007E+09  1.545275E+10  2.227060E+10
      1977        2.971860E+10  3.614817E+10  4.263569E+10

FSAP2 - DATE REVISED:  8/21/80

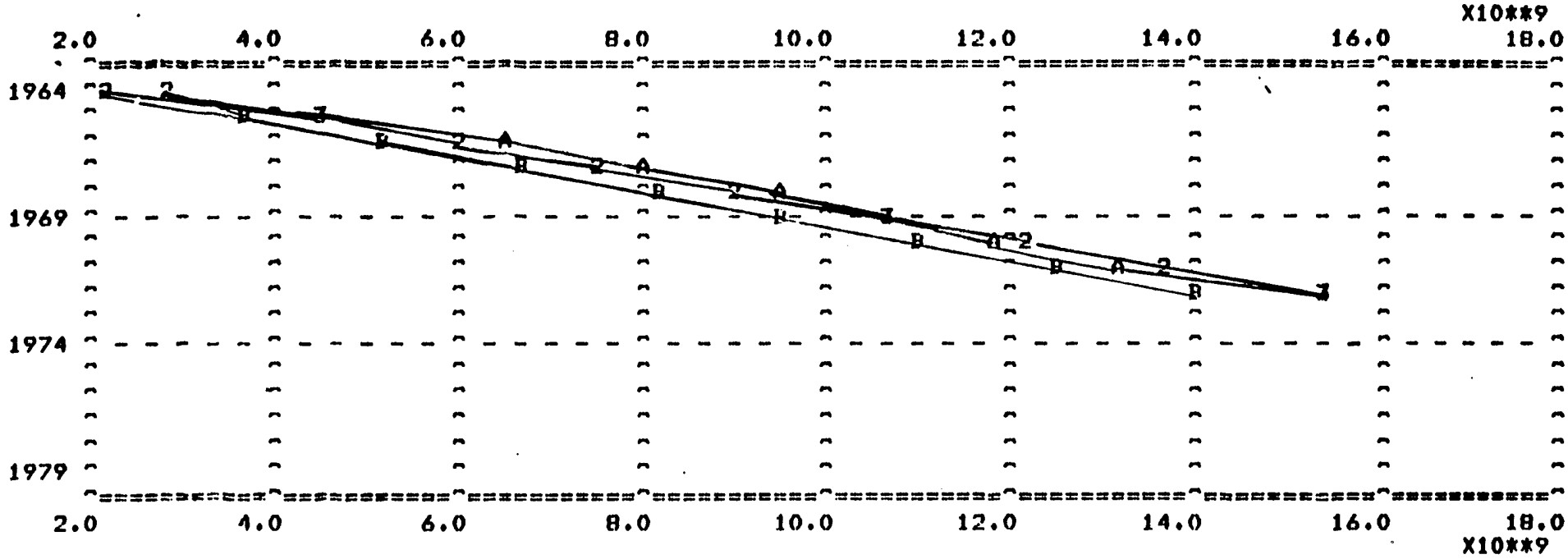
    ANNUAL DATA FROM 1973 TO 1981
COMMENT:
FSAP2 = FSAP2*1000

    DATA
      1973        1.991632E+09  6.772085E+09  1.421110E+10  2.086473E+10
      1977        2.784684E+10  3.337997E+10  3.858806E+10  4.427942E+10
      1981        5.364203E+10

SAPTCUM2 - DATE REVISED:  8/21/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
SAPTCUM2 = EURSUM2+EAPSUM2+NEASUM2+AFRSUM2+LASUM2

    DATA
      1973        2.629275E+09  7.167967E+09  1.674077E+10  2.510685E+10
      1977        2.893727E+10  3.542271E+10  4.227946E+10
```

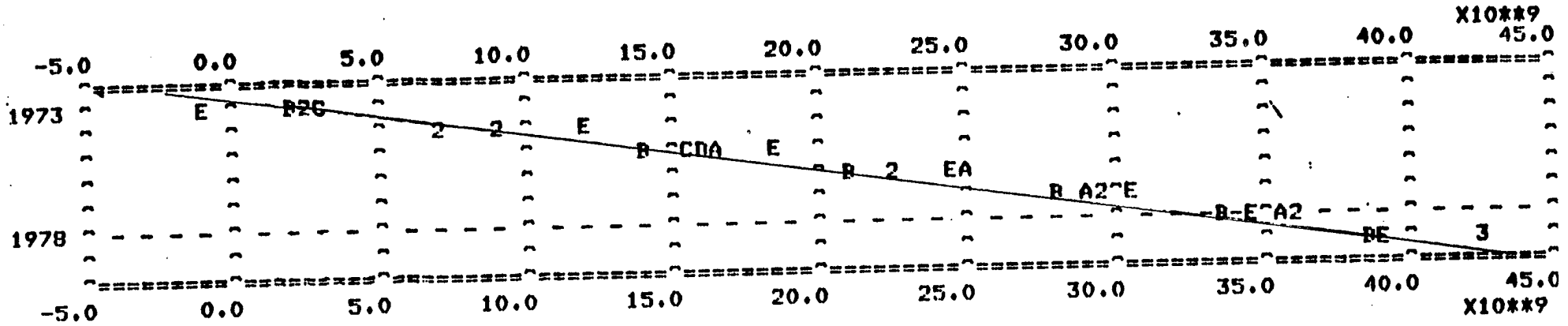


**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	SAPTCUM1
B	#1	FSAP1
C	#1	SAPTF1
D	#1	TCUM1

****

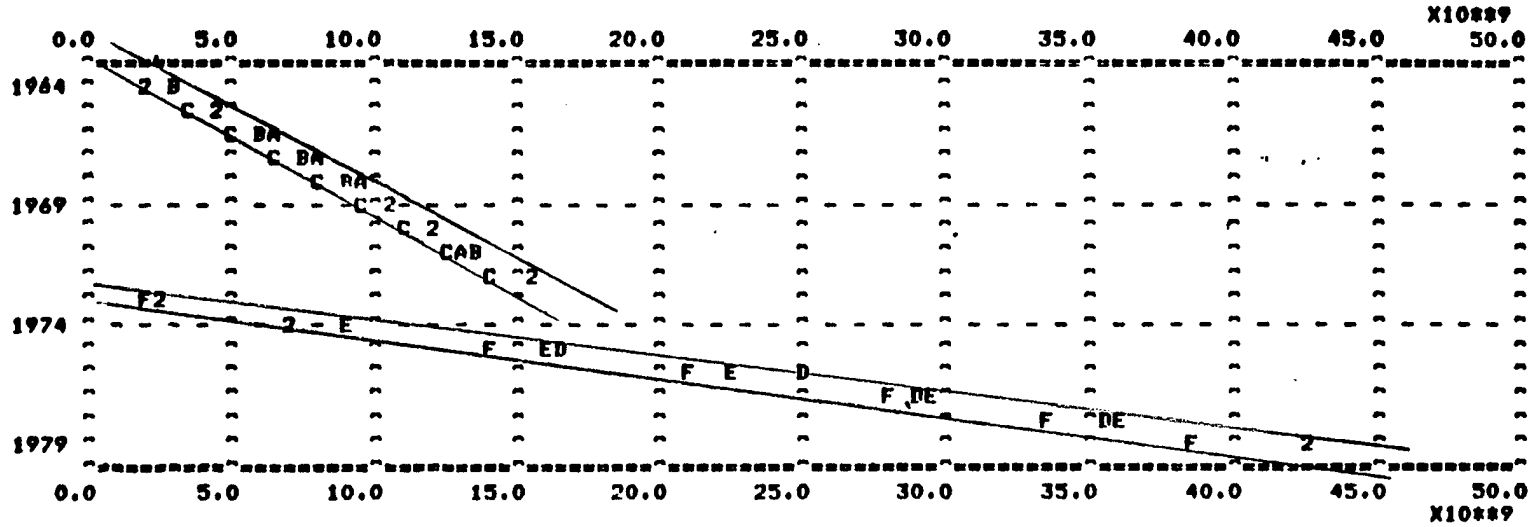


**********LEGEND**********

TIME BOUNDS: 1973 TO 1979

SYMBOL	SCALE	NAME
A	#1	SAPTCUM2
B	#1	FSAP2
C	#1	SAPTF2
D	#1	TCUM2
E	#1	TCUM3

****



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	SAPTCUM1
B	#1	TCUM1
C	#1	FSAP1
D	#1	SAPTCUM2
E	#1	TCUM2
F	#1	FSAP2

****

```
    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
SAPTCUM2 = SAPTCUM2*1000

    DATA
      1973      2.629274E+09  7.167971E+09  1.674075E+10  2.510683E+10
      1977      2.893724E+10  3.542269E+10  4.227944E+10

TCUM2 - DATE REVISED:  8/20/80

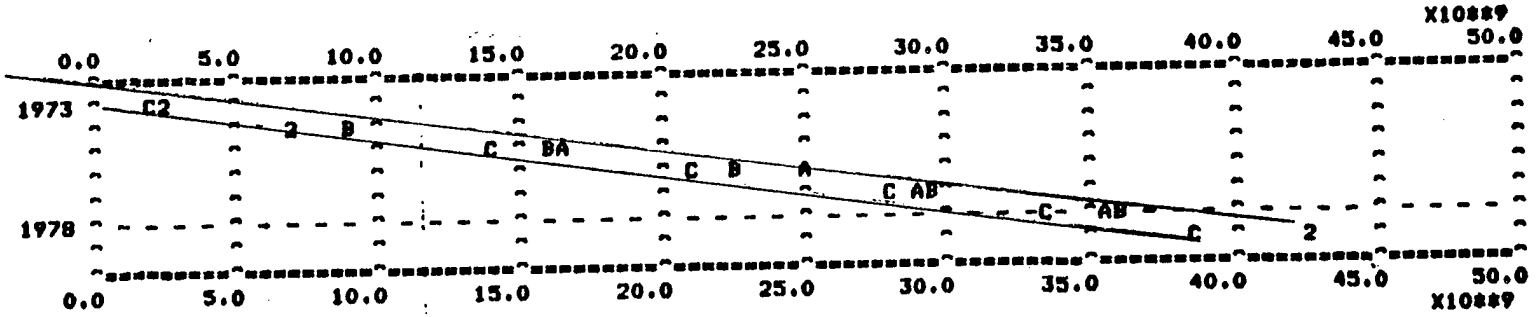
    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 5
 IN MODEL SALCYC

    DATA
      1973      2.505982E+09  9.207996E+09  1.591001E+10  2.261203E+10
      1977      2.931404E+10  3.601605E+10  4.271807E+10

FSAP2 - DATE REVISED:  8/20/80

    ANNUAL DATA FROM 1973 TO 1981
COMMENT:
FSAP2 = FSAP

    DATA
      1973      1.991632E+09  6.772085E+09  1.421110E+10  2.086475E+10
      1977      2.784686E+10  3.337998E+10  3.858808E+10  4.427944E+10
      1981      5.364205E+10
```




```
**********LEGEND**********

TIME BOUNDS: 1973 TO 1979

SYMBOL SCALE NAME
   A    *1   SAPTCUM2
   B    *1   TCUM2
   C    *1   FSAP2

**********
```

SAPTCUM1 - DATE REVISED: 8/20/80

ANNUAL DATA FROM 1964 TO 1972

COMMENT:

TCUM1 = SAPTCUM1/1000

[illegible]	[illegible]	[illegible]	[illegible]E+09	8.006382E+09
1968	9.541632E+09	1.074355E+10	1.208411E+10	1.316260E+10
1972	1.536284E+10			

TCUM1 - DATE REVISED: 8/20/80

ANNUAL DATA FROM 1964 TO 1972

COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 4
IN MODEL SALCYC

DATA

1964	2.893578E+09	4.439978E+09	5.986374E+09	7.532769E+09
1968	9.079165E+09	1.062556E+10	1.217196E+10	1.371836E+10
1972	1.526475E+10			

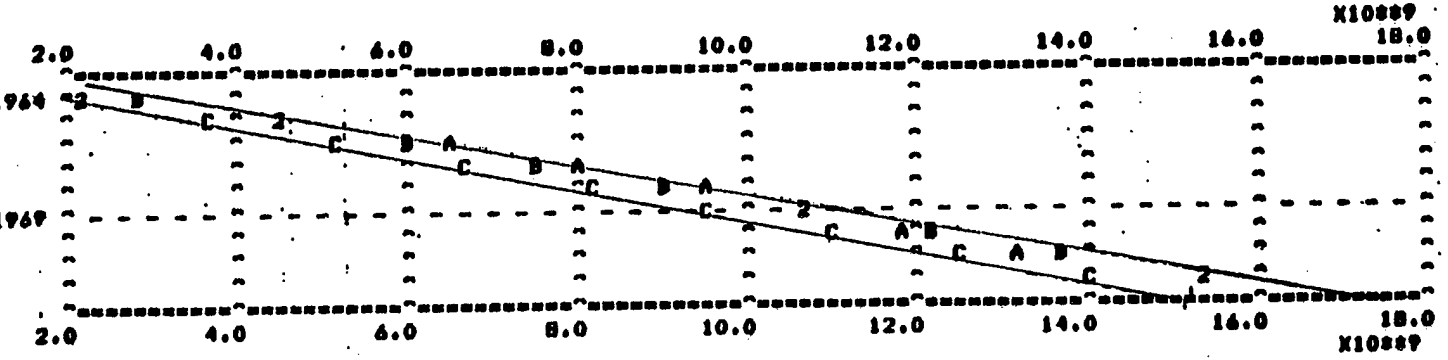
FSAP1 - DATE REVISED: 8/20/80

ANNUAL DATA FROM 1964 TO 1972

COMMENT:
FSAP1 = ARHRHS1+NAVRHS1+AFRHS1

DATA

1964	2.212983E+09	3.684474E+09	5.159952E+09	6.633435E+09
1968	8.106918E+09	9.580401E+09	1.105389E+10	1.252737E+10
1972	1.400086E+10			



**********LEGEND**********

TIME BOUNDS: 1964 TO 1972

SYMBOL	SCALE	NAME
A	01	SAPTCUM1
B	01	TCUM1
C	01	FSAP1

APPENDIX C

REGRESSION ANALYSIS OF SERVICE SALES PROGRAMS

For each regression analysis, the following statistics are generated:

NOB is the number of observations (30 for the entire period 1950-1979).

NOVAR is the number of coefficients to be determined $\sum_{i=1}^{n} (a_i)$ = NOVAR.

Range is the years of data used.

RSQ is the square of the coefficient of correlation (i.e., the coefficient determination)

CSRQ is the adjusted value of the coefficient of determination.

SER is the standard error of the regression [i.e., $\sqrt{SSR/(NOB - NOVAR)}$].

SSR is the sum of the squares of the differences (or residuals) between the actual values observed (LHS) and the values forecast by the test equation (RHS).

F(a/b) is the F test which measures how well the test equation fits the data.

DW(Ø) is the Durbin-Watson statistic which tests whether an autocorrelation of one-time lag is present in the residuals. If the DW range is between 1.5 and 2.5, no autocorrelation exists.

ST ER is the standard error in the values of the equation coefficient as developed by the regression.

T-STAT is the number of times the standard error in the values of the equation coefficients as determined by the regression can be divided into that value.

LHS is the left hand side or actual data observed.

RHS is the right hand side or computed data developed.

RESIDUAL is the difference between the actual data (LHS) and the computed data (RHS).

- Page C-4 shows the total sales of the three Services and the value of each Service component.[1] In the plot:
  - TOT 1 represents the value of Air Force sales over the period 1964-1979.
  - TOT 2 represents the sum of Air Force sales and Army sales. Thus, the increment between TOT 1 and TOT 2 is equal to the dollar value of Army Sales.
  - TOT 3 represents the sum of Air Force, Army, and Navy sales. Thus, the increment between TOT 2 and TOT 3 is equal to the dollar value of Navy sales.
  - TOT 3 is also the total value of all sales. Thus, when the sum of the Service sales increments are plotted against TOT 3, the plots coincide exactly.
- Page C-5 plots the cumulative Army sales for 1964-1972 and 1973-1979.
- Page C-6 regresses the cumulative Army sales over the period 1964-1972.
- Page C-7 regresses the cumulative Army sales over the period 1973-1979.
- Page C-8 plots the regression equations together with the cumulative Army sales values.
- Pages C-9 through C-12 treat cumulative Navy sales.
- Pages C-13 through C-16 treat cumulative Air Force sales.
- Page C-17 regresses cumulative Air Force sales for 1964-1972 against the cumulative Air Force sales for 1973-1979 to determine the relationship between them.

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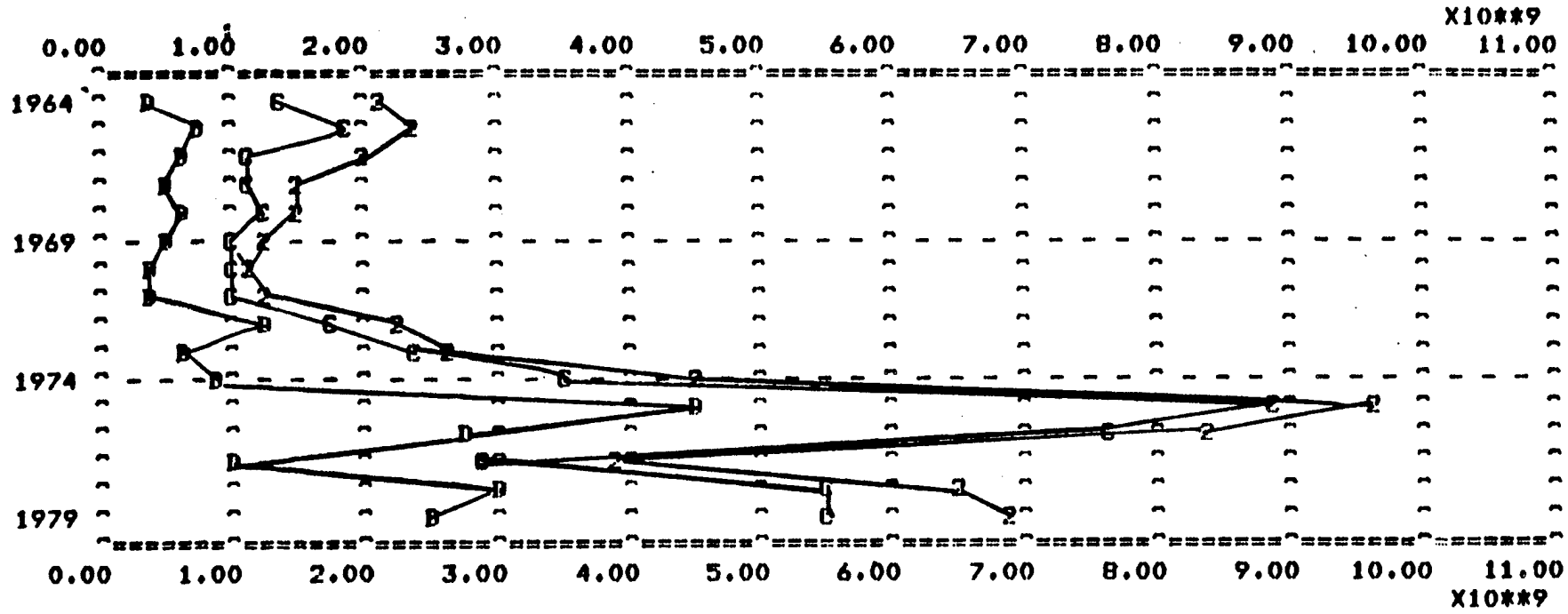
[1] The Indochina countries and Iran have been excluded in this example of analysis



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	SAPTOTC
B	#1	TOT3
C	#1	TOT2
D	#1	TOT1

****

```
ARMCUMCOMMANDS REVISED!  8/20/80

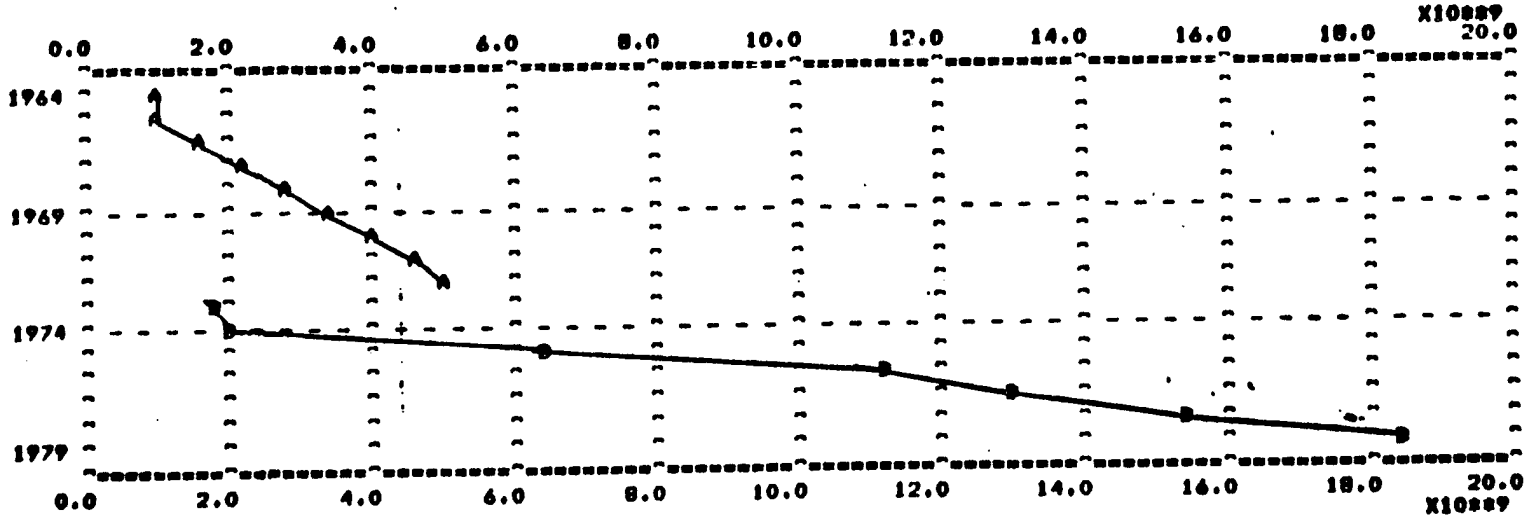
    ANNUAL DATA FROM 1964 TO 1972.
COMMENT!
ARMCUM1 = ARMCUM1@100000000

    DATA
      1964       9.613960E+08  1.082926E+09  1.618022E+09  2.277809E+09
      1968       2.895755E+09  3.417625E+09  3.936757E+09  4.513219E+09
      1972       5.026394E+09

ARMCUM2 - DATE REVISED!  8/20/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT!
ARMCUM2 = ARMCUM2@100000000

    DATA
      1973       1.718945E+09  1.984314E+09  6.408397E+09  1.118479E+10
      1977       1.298740E+10  1.543064E+10  1.843536E+10
```




```
**********************************************LEGEND**********************************************

TIME ROUNDS! 1964 TO 1979

SYMBOL SCALE NAME
   A     01   ARMCUM1
   B     01   ARMCUM2

**************************************************************************************************
```

13: ARMCUM1 = A1+A2*TIM

NOB = 9 NOVAR = 2
RANGE = 1964 TO 1972
RSQ = 0.99295 CRSQ = 0.99194 F(1/7) = 985.974
SER = 1.33E+08 SSR = 1.237E+17 DW(0) = 1.60

COEF	VALUE	ST ER	T-STAT
A1	-7.37837E+09	3.29021E+08	-22.42520
A2	5.38803E+08	1.71592E+07	31.40020

DATE	LHS	RHS	RESIDUAL
1964	9.613960E+08	7.036682E+08	2.577277E+08
1965	1.082926E+09	1.242472E+09	-1.595469E+08
1966	1.618022E+09	1.781273E+09	-1.632504E+08
1967	2.277809E+09	2.320077E+09	-4.226790E+07
1968	2.895755E+09	2.858877E+09	3.687782E+07
1969	3.417625E+09	3.397681E+09	1.994419E+07
1970	3.936757E+09	3.936485E+09	271360.
1971	4.513219E+09	4.475286E+09	3.793306E+07
1972	5.026394E+09	5.014090E+09	1.230438E+07

ARMRHS1 - DATE REVISED: 8/20/80

ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 13
IN MODEL NULL

DATA				
1964	7.036682E+08	1.242472E+09	1.781273E+09	2.320077E+09
1968	2.858877E+09	3.397681E+09	3.936485E+09	4.475286E+09
1972	5.014090E+09			

```
14:  ARMCUM2 = A1+A2*TIMPD

NOB = 7      NOVAR = 2
RANGE =  1973 TO 1979
RSQ =   0.9747       CRSQ =   0.96964      F(1/5) =   192.616
SER = 1.14E+09       SSR = 6.483E+18       DW(0) =  2.22

COEF          VALUE           ST ER          T-STAT

A1        -2.21015E+09    9.62333E+08       -2.29666
A2         2.98646E+09    2.15184E+08       13.87860

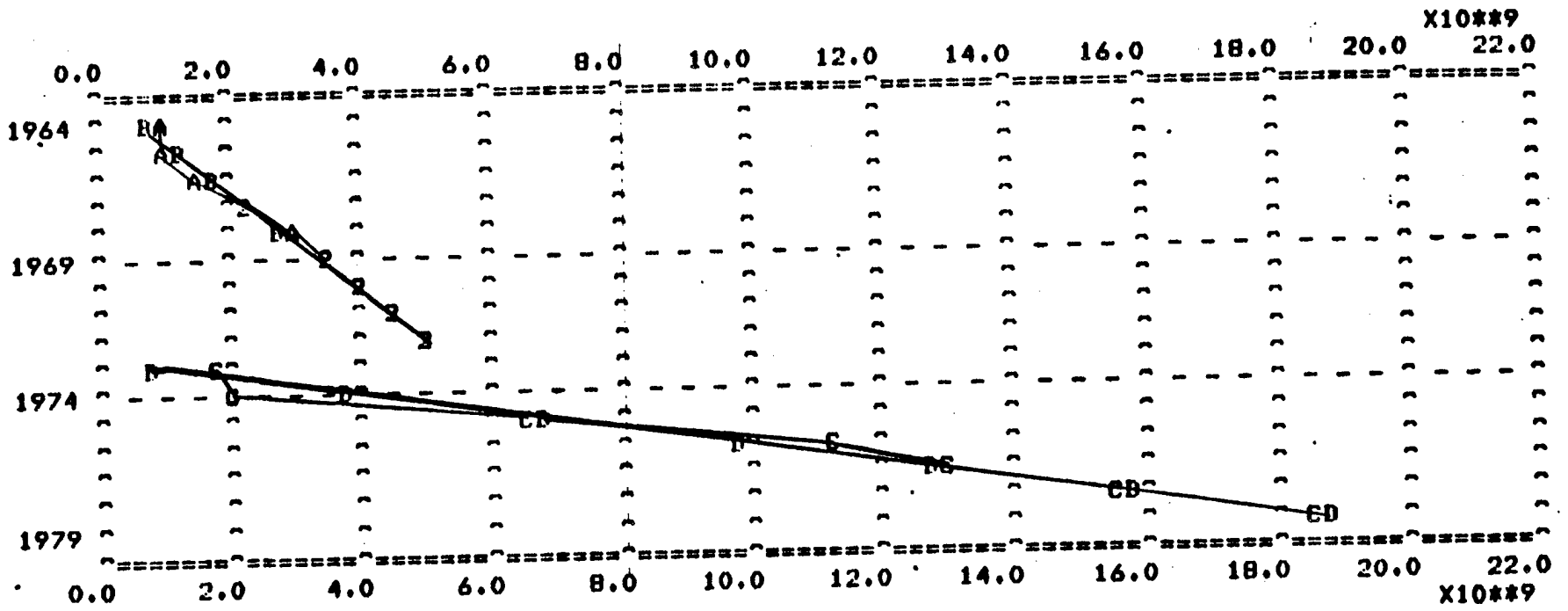

 DATE          LHS             RHS           RESIDUAL

1973        1.718945E+09   7.763098E+08    9.426355E+08
1974        1.984314E+09   3.762771E+09   -1.778457E+09
1975        6.408397E+09   6.749229E+09   -3.408323E+08
1976        1.118479E+10   9.735692E+09    1.449099E+09
1977        1.298740E+10   1.272215E+10    2.652529E+08
1978        1.543064E+10   1.570861E+10   -2.779709E+08
1979        1.843536E+10   1.869507E+10   -2.597110E+08

ARMRHS2 - DATE REVISED:  8/20/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 14
 IN MODEL NULL

    DATA
      1973       7.763098E+08  3.762771E+09  6.749229E+09  9.735692E+09
      1977       1.272215E+10  1.570861E+10  1.869507E+10
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	ARMCUM1
B	#1	ARMRHS1
C	#1	ARMCUM2
D	#1	ARMRHS2

****

NAVCUM1 - DATE REVISED: 8/20/80

ANNUAL DATA FROM 1964 TO 1972
COMMENT:
NAVCUM1 = NAVCUM1*100000000

DATA

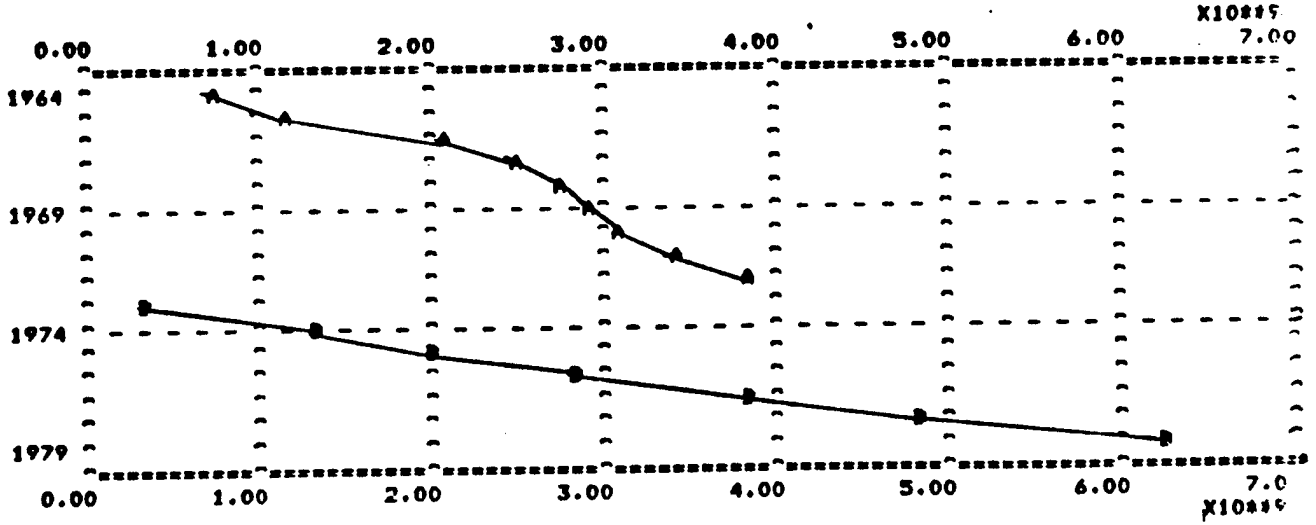
1964	7.349245E+08	1.177270E+09	2.076137E+09	2.493789E+09
1968	2.735352E+09	2.914586E+09	3.114566E+09	3.398671E+09
1972	3.836830E+09			

NAVCUM2 - DATE REVISED: 8/20/80

ANNUAL DATA FROM 1973 TO 1979
COMMENT:
NAVCUM2 = NAVCUM2*100000000

DATA

1973	3.140436E+08	1.325873E+09	2.009828E+09	2.808226E+09
1977	3.814645E+09	4.831904E+09	6.208352E+09	



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	01	NAVCUM1
B	01	NAVCUM2

10: NAVCUM1 = A1+A2*TIM

NOB = 9 NOVAR = 2
RANGE = 1964 TO 1972
RSQ = 0.94052 CRSQ = 0.93202 F(1/7) = 110.678
SER = 2.65E+08 SSR = 4.904E+17 DW(0) = 0.78

COEF	VALUE	ST ER	T-STAT
A1	-4.33232E+09	6.55217E+08	-6.61203
A2	3.59491E+08	3.41710E+07	10.52040

DATE	LHS	RHS	RESIDUAL
1964	7.349245E+08	1.060049E+09	-3.251244E+08
1965	1.177270E+09	1.419543E+09	-2.422725E+08
1966	2.076137E+09	1.779032E+09	2.971046E+08
1967	2.493789E+09	2.138522E+09	3.552678E+08
1968	2.735352E+09	2.498015E+09	2.373363E+08
1969	2.914586E+09	2.857505E+09	5.708109E+07
1970	3.114566E+09	3.216998E+09	-1.024325E+08
1971	3.398671E+09	3.576488E+09	-1.778171E+08
1972	3.836830E+09	3.935982E+09	-9.915162E+07

NAVRHS1 - DATE REVISED: 8/20/80

ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 10
IN MODEL NULL

DATA				
1964	1.060049E+09	1.419543E+09	1.779032E+09	2.138522E+09
1968	2.498015E+09	2.857505E+09	3.216998E+09	3.576488E+09
1972	3.935982E+09			

```
11: NAVCUM2 = A1+A2*TIMPD


NOB = 7      NOVAR = 2
RANGE =  1973 TO 1979
RSQ =   0.99          CRSQ =   0.988        F(1/5) =   494.964
SER = 2.25E+08        SSR = 2.534E+17       DW(0) =  1.14

COEF            VALUE            ST ER          T-STAT

A1        -7.40990E+08     1.90245E+08        -3.89493
A2         9.46422E+08     4.25400E+07         22.24780

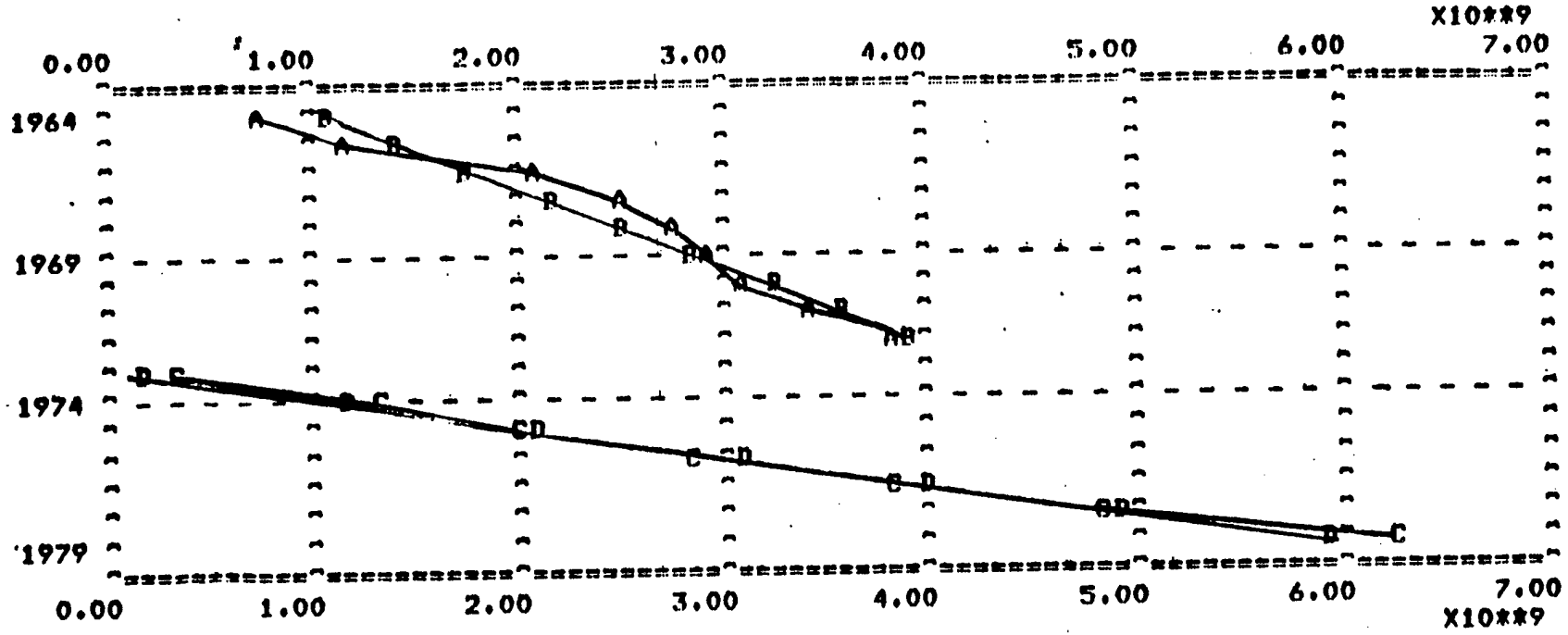

 DATE          LHS              RHS            RESIDUAL

1973        3.140436E+08     2.054310E+08     1.086126E+08
1974        1.325873E+09     1.151853E+09     1.740204E+08
1975        2.009828E+09     2.098274E+09    -8.844595E+07
1976        2.808226E+09     3.044696E+09    -2.364698E+08
1977        3.814645E+09     3.991114E+09    -1.764690E+08
1978        4.831904E+09     4.937535E+09    -1.056317E+08
1979        6.208352E+09     5.883957E+09     3.243950E+08


NAVRHS2 - DATE REVISED:  8/20/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 11
 IN MODEL NULL

    DATA
      1973        2.054310E+08  1.151853E+09  2.098274E+09  3.044696E+09
      1977        3.991114E+09  4.937535E+09  5.883957E+09
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	NAVCUM1
B	#1	NAVRHS1
C	#1	NAVCUM2
D	#1	NAVRHS2

****

AFCUM1 - DATE REVISED: 8/20/80

ANNUAL DATA FROM 1964 TO 1972

COMMENTS:

AFCUM1 = AFCUM1*100000000

DATA.

1964	3.935370E+08	1.104315E+09	1.675192E+09	2.141022E+09
1968	2.816766E+09	3.317504E+09	3.739027E+09	4.156949E+09
1972	5.405852E+09			

AFCUM2 - DATE REVISED: 8/20/80

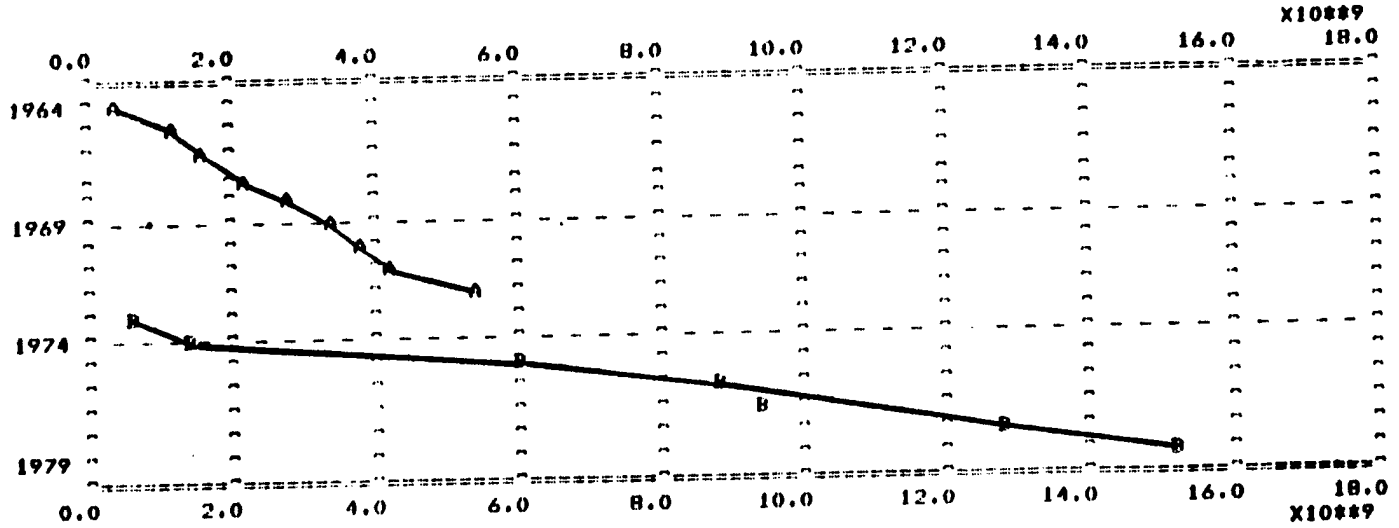
ANNUAL DATA FROM 1973 TO 1979

COMMENTS:

AFCUM2 = AFCUM2*100000000

DATA

1973	5.962857E+08	1.469475E+09	5.934211E+09	8.725508E+09
1977	9.446904E+09	1.277184E+10	1.524743E+10	



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	01	AFCUM1
B	01	AFCUM2

****

7: AFCUM1 = A1+A2*TIM

NOB = 9 NOVAR = 2
RANGE = 1964 TO 1972
RSQ = 0.98636 CRSQ = 0.98441 F(1/7) = 506.215
SER = 1.98E+08 SSR = 2.745E+17 DW(0) = 2.00

COEF	VALUE	ST ER	T-STAT
A1	-8.17858E+09	4.90197E+08	-16.68430
A2	5.75190E+08	2.55649E+07	22.49920

DATE	LHS	RHS	RESIDUAL
1964	3.935370E+08	4.492657E+08	-5.572864E+07
1965	1.104315E+09	1.024459E+09	7.985664E+07
1966	1.675192E+09	1.599648E+09	7.554432E+07
1967	2.141022E+09	2.174837E+09	-3.381504E+07
1968	2.816766E+09	2.750026E+09	6.674048E+07
1969	3.317584E+09	3.325215E+09	-7.630592E+06
1970	3.739027E+09	3.900404E+09	-1.613765E+08
1971	4.156949E+09	4.475597E+09	-3.186481E+08
1972	5.405852E+09	5.050786E+09	3.550659E+08

AFRHS1 - DATE REVISED: 8/20/80

ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 7
IN MODEL NULL

DATA				
1964	4.492657E+08	1.024459E+09	1.599648E+09	2.174837E+09
1968	2.750026E+09	3.325215E+09	3.900404E+09	4.475597E+09
1972	5.050786E+09			

8: AFCUM2 = A1+A2*TIMPD

NOB = 7 NOVAR = 2
RANGE = 1973 TO 1979
RSQ = 0.97866 CRSQ = 0.97439 F(1/5) = 229.270
SER = 8.75E+08 SSR = 3.824E+18 DW(0) = 2.73

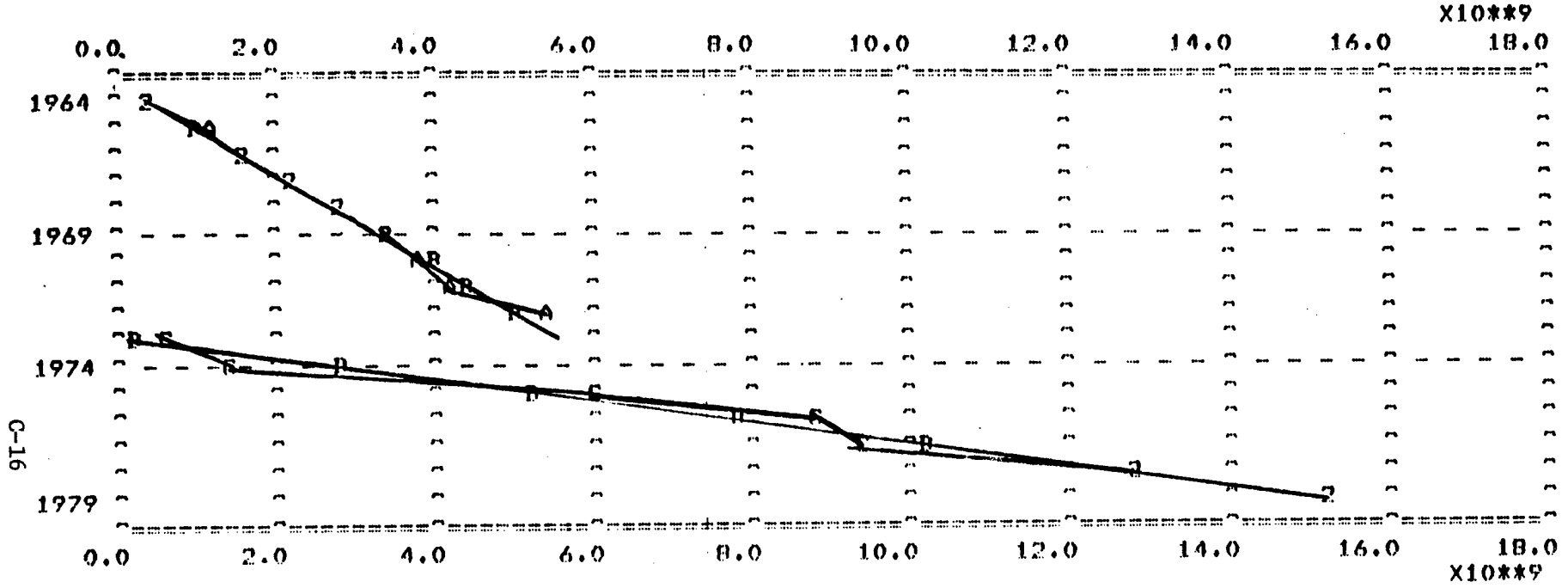
COEF	VALUE	ST ER	T-STAT
A1	-2.26846E+09	7.39130E+08	-3.06909
A2	2.50253E+09	1.65275E+08	15.14170

DATE	LHS	RHS	RESIDUAL
1973	5.962857E+08	2.340728E+08	3.622129E+08
1974	1.469475E+09	2.736600E+09	-1.267126E+09
1975	5.934211E+09	5.239132E+09	6.950789E+08
1976	8.725508E+09	7.741661E+09	9.838469E+08
1977	9.446904E+09	1.024419E+10	-7.972864E+08
1978	1.277184E+10	1.274672E+10	2.511667E+07
1979	1.524743E+10	1.524925E+10	-1.822720E+06

AFRHS2 - DATE REVISED: 8/20/80

ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 8
IN MODEL NULL

DATA				
1973	2.340728E+08	2.736600E+09	5.239132E+09	7.741661E+09
1977	1.024419E+10	1.274672E+10	1.524925E+10	



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	AFCUM1
B	#1	AFRHS1
C	#1	AFCUM2
D	#1	AFRHS2

****

```
ZZ1 - DATE REVISED:  8/20/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
Z1 = AFCUM1

    DATA
      1964        3.935370E+08  1.104315E+09  1.675192E+09  2.141022E+09
      1968        2.816766E+09  3.317584E+09  3.739027E+09  4.156949E+09
      1972        5.405852E+09

Z2 - DATE REVISED:  8/20/80

    ANNUAL DATA FROM 1964 TO 1970
COMMENT:
Z2 = AFCUM2

    DATA
      1964        5.962857E+08  1.469475E+09  5.934211E+09  8.725508E+09
      1968        9.446904E+09  1.277184E+10  1.524743E+10

9:  Z2 = B1+B2*Z1


NOB = 7     NOVAR = 2
RANGE =  1964 TO 1970
RSQ =   0.9667      CRSQ =   0.96003     F(1/5) =   145.131
SER = 1.09E+09      SSR = 5.967E+18      DW(0) =  2.72


COEF          VALUE          ST ER          T-STAT

B1       -1.92020E+09   9.02067E+08       -2.12867
B2            4.45323        0.36965       12.04700


Z22 - DATE REVISED:  8/20/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
Z22 = -1.920200E09+4.45323*Z1

    DATA
      1964       -1.676892E+08  2.997568E+09  5.539811E+09  7.614259E+09
      1968        1.062350E+10  1.285376E+10  1.473054E+10  1.659165E+10
      1972        2.215330E+10
```

APPENDIX D

REGRESSION ANALYSIS OF COMMODITY GROUP PROGRAMS

For each regression analysis, the following statistics are generated:

NOB is the number of observations (30 for the entire period 1950-1979).

NOVAR is the number of coefficients to be determined $\sum_{i=1}^{n} (a_i)$ = NOVAR.

Range is the years of data used.

RSQ is the square of the coefficient of correlation (i.e., the coefficient determination)

CSRQ is the adjusted value of the coefficient of determination.

SER is the standard error of the regression [i.e., $\sqrt{SSR/(NOB - NOVAR)}$].

SSR is the sum of the squares of the differences (or residuals) between the actual values observed (LHS) and the values forecast by the test equation (RHS).

F(a/b) is the F test which measures how well the test equation fits the data.

DW(Ø) is the Durbin-Watson statistic which tests whether an autocorrelation of one-time lag is present in the residuals. If the DW range is between 1.5 and 2.5, no autocorrelation exists.

ST ER is the standard error in the values of the equation coefficient as developed by the regression.

T-STAT is the number of times the standard error in the values of the equation coefficients as determined by the regression can be divided into that value.

LHS is the left hand side or actual data observed.

RHS is the right hand side or computed data developed.

RESIDUAL is the difference between the actual data (LHS) and the computed data (RHS).

FMS and MAP sales data for the three Services were aggregated to form 16 commodity groups. For example, CUMAIR1 equals Army, Navy, and Air Force aircraft adjusted by CPI.

Each commodity group was divided into two data sets, 1964-1972 and 1973-1979 in relation to the approximate 22-year cycles discussed in this report. Each year group was then regressed using the following equations:

1964-1972	$A_1 + A_2(\text{Time})$
1973-1979	$A_1 + A_2(\text{Time}_1)$

Actual and forecast data were cumulated and plotted against each other for both periods:

- The plots show approximate straight lines.
- The coefficients of determination were generally above .97.

Where the regression fits were below .96, new regressions were performed using year groupings more representative of the commodity group data rather than the 22-year cycle determined from the total sales data base generally. Better regression fits resulted from the selection of new cycles. (These new equations are identified by the last two characters being 11 or 22, i.e., CUMAIR11.)

The selected cycle times confirm an overall time cycle of 20-23 years' duration.

Page D-5 shows the 46 equations used to regress the 16 commodity groups. The R&D group proved to have no pattern and is not shown in this appendix. The commodity groups, the equation acronyms, and appendix page numbers are listed below:

COEFFICIENT:
A1 A2 A3

EQUATIONS

1: CUMAIR1 = A1+A2*TIM
2: CUMAIR2 = A1+A2*TIMPD
3: CUMMIS1 = A1+A2*TIM
4: CUMMIS2 = A1+A2*TIMPD
5: CUMTACS1 = A1+A2*TIM
6: CUMTACS2 = A1+A2*TIMPD
7: CUMWEAP1 = A1+A2*TIM
8: CUMWEAP2 = A1*A2*TIMPD
9: CUMAMMO1 = A1+A2*TIM
10: CUMAMMO2 = A1+A2*TIMPD
11: CUMCOM1 = A1+A2*TIM
12: CUMCOM2 = A1+A2*TIMPD
13: CUMSPT1 = A1+A2*TIM
14: CUMSPT2 = A1+A2*TIMPD
15: CUMSUP1 = A1+A2*TIM
16: CUMSUP2 = A1+A2*TIMPD
17: CUMSOPS1 = A1+A2*TIM
18: CUMSOPS2 = A1+A2*TIMPD
19: CUMEQMN1 = A1+A2*TIM
20: CUMEQMN2 = A1+A2*TIMPD
21: CUMSPEC1 = A1+A2*TIM
22: CUMSPEC2 = A1+A2*TIMPD
23: CUMSHIP1 = A1+A2*TIM
24: CUMSHIP2 = A1+A2*TIMPD
25: CUMTR1 = A1+A2*TIM
26: CUMTR2 = A1+A2*TIMPD
27: CUMAIR11 = A1+A2*TIM
28: CUMAIR22 = A1+A2*TIMPDX1
29: CUMTAC11 = A1+A2*TIM
30: CUMTAC22 = A1+A2*TIMPDX2
31: CUMAMM11 = A1+A2*TIM
32: CUMAMM22 = A1+A2*TIMPDX3
33: CUMCOM11 = A1+A2*TIM
34: CUMCOM22 = A1+A2*TIMPDX4
35: CUMSUP11 = A1+A2*TIM
36: CUMSUP22 = A1+A2*TIMPDX5
37: CUMEQ11 = A1+A2*TIM
38: CUMEQ22 = A1+A2*TIMPDX6
39: CUMCON1 = A1+A2*TIM
40: CUMCON2 = A1+A2*TIMPD
41: CUMRAND1 = A1+A2*TIM
42: CUMRAND2 = A1+A2*TIMPD
43: CUMCON11 = A1+A2*TIM
44: CUMCON22 = A1+A2*TIMPDX1
45: CUMCV1 = A1+A2*TIM
46: CUMCV2 = A1+A2*TIMPD

```
1:  CUMAIR1 = A1+A2*TIM


NOB = 9      NOVAR = 2
RANGE =  1964 TO 1972
RSQ =   0.97959      CRSQ =   0.97667      F(1/7) =   335.928
SER = 3.17E+08       SSR = 7.040E+17       DW(0) =  1.49


COEF            VALUE           ST ER          T-STAT

A1         -1.09118E+10     7.85029E+08       -13.89990
A2          7.50381E+08     4.09410E+07        18.32830


 DATE           LHS             RHS           RESIDUAL

1964         3.064799E+08    3.439288E+08   -3.744896E+07
1965         1.062617E+09    1.094312E+09   -3.169510E+07
1966         2.117801E+09    1.844691E+09    2.731100E+08
1967         2.686381E+09    2.595074E+09    9.130675E+07
1968         3.319650E+09    3.345453E+09   -2.580275E+07
1969         3.992948E+09    4.095836E+09   -1.028877E+08
1970         4.423909E+09    4.846215E+09   -4.223058E+08
1971         5.279273E+09    5.596598E+09   -3.173253E+08
1972         6.920012E+09    6.346977E+09    5.730345E+08

%

2:  CUMAIR2 = A1+A2*TIMPD


NOB = 7      NOVAR = 2
RANGE =  1973 TO 1979
RSQ =   0.96381      CRSQ =   0.95657      F(1/5) =   133.146
SER = 9.81E+08       SSR = 4.812E+18       DW(0) =  1.35


COEF            VALUE           ST ER          T-STAT

A1          9.24774E+08     8.29124E+08        1.11536
A2          2.13929E+09     1.85398E+08       11.53890


 DATE           LHS             RHS           RESIDUAL

1973         2.074845E+09    3.064059E+09   -9.892137E+08
1974         4.759290E+09    5.203341E+09   -4.440515E+08
1975         8.771424E+09    7.342625E+09    1.428799E+09
1976         1.037300E+10    9.481908E+09    8.910930E+08
1977         1.141972E+10    1.162120E+10   -2.014740E+08
1978         1.393056E+10    1.376048E+10    1.700782E+08
1979         1.504456E+10    1.589977E+10   -8.552038E+08
```

```
AIR1FC - DATE REVISED:  9/22/80

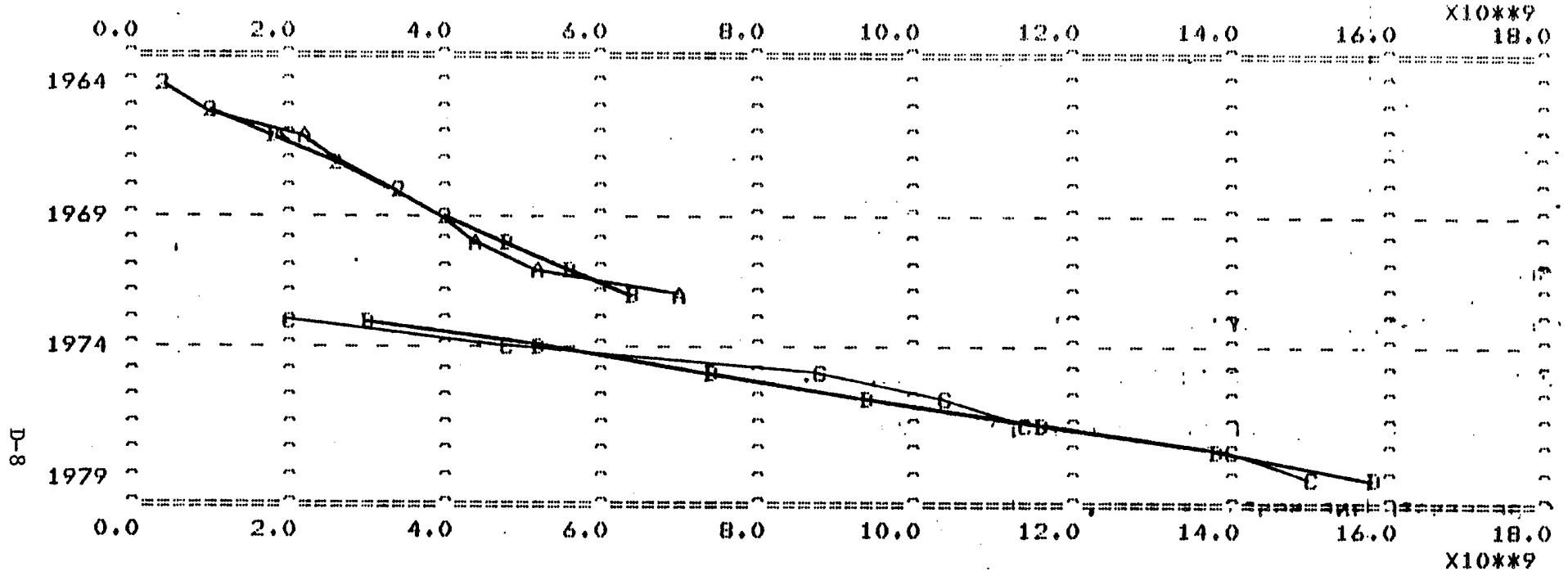
    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 1
 IN MODEL COMMODFC

    DATA
      1964      3.439288E+08  1.094312E+09  1.844691E+09  2.595074E+09
      1968      3.345453E+09  4.095836E+09  4.846215E+09  5.596598E+09
      1972      6.346977E+09

AIR2FC - DATE REVISED:  9/22/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 2
 IN MODEL COMMODFC

    DATA
      1973      3.064059E+09  5.203341E+09  7.342625E+09  9.481908E+09
      1977      1.162120E+10  1.376048E+10  1.589977E+10
```



D-8

**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMAIR1
B	#1	AIR1FC
C	#1	CUMAIR2
D	#1	AIR2FC

****

```
27:  CUMAIR11 = A1+A2*TIM

NOB = 8      NOVAR = 2
RANGE =  1964 TO 1971
RSQ =   0.99124      CRSQ =   0.98978      F(1/6) =   678.706
SER = 1.71E+08       SSR = 1.763E+17       DW(0) =  1.42

COEF          VALUE          ST ER          T-STAT

A1       -9.84759E+09    4.92999E+08      -19.97490
A2        6.88985E+08    2.64465E+07       26.05200


 DATE          LHS            RHS          RESIDUAL

1964       3.064799E+08   4.871823E+08  -1.807025E+08
1965       1.062617E+09   1.176170E+09  -1.135537E+08
1966       2.117801E+09   1.865155E+09   2.526464E+08
1967       2.686381E+09   2.554139E+09   1.322422E+08
1968       3.319650E+09   3.243123E+09   7.652762E+07
1969       3.992948E+09   3.932107E+09   6.084173E+07
1970       4.423909E+09   4.621091E+09  -1.971814E+08
1971       5.279273E+09   5.310079E+09  -3.080602E+07

%

28:  CUMAIR22 = A1+A2*TIMPDX1

NOB = 8      NOVAR = 2
RANGE =  1972 TO 1979
RSQ =   0.9749       CRSQ =   0.97072      F(1/6) =   233.079
SER = 9.41E+08       SSR = 5.311E+18       DW(0) =  1.23

COEF          VALUE          ST ER          T-STAT

A1       -3.61564E+07    7.33091E+08       -0.04932
A2        2.21635E+09    1.45174E+08       15.26690


 DATE          LHS            RHS          RESIDUAL

1972       1.640742E+09   2.180193E+09  -5.394516E+08
1973       3.715587E+09   4.396540E+09  -6.809528E+08
1974       6.400033E+09   6.612890E+09  -2.128568E+08
1975       1.041217E+10   8.829239E+09   1.582928E+09
1976       1.201374E+10   1.104559E+10   9.681551E+08
1977       1.306046E+10   1.326194E+10  -2.014740E+08
1978       1.557130E+10   1.547829E+10   9.301197E+07
1979       1.668531E+10   1.769464E+10  -1.009332E+09
```

AIR11FC - DATE REVISED: 9/22/80

ANNUAL DATA FROM 1964 TO 1971
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 27
IN MODEL COMMODFC

DATA

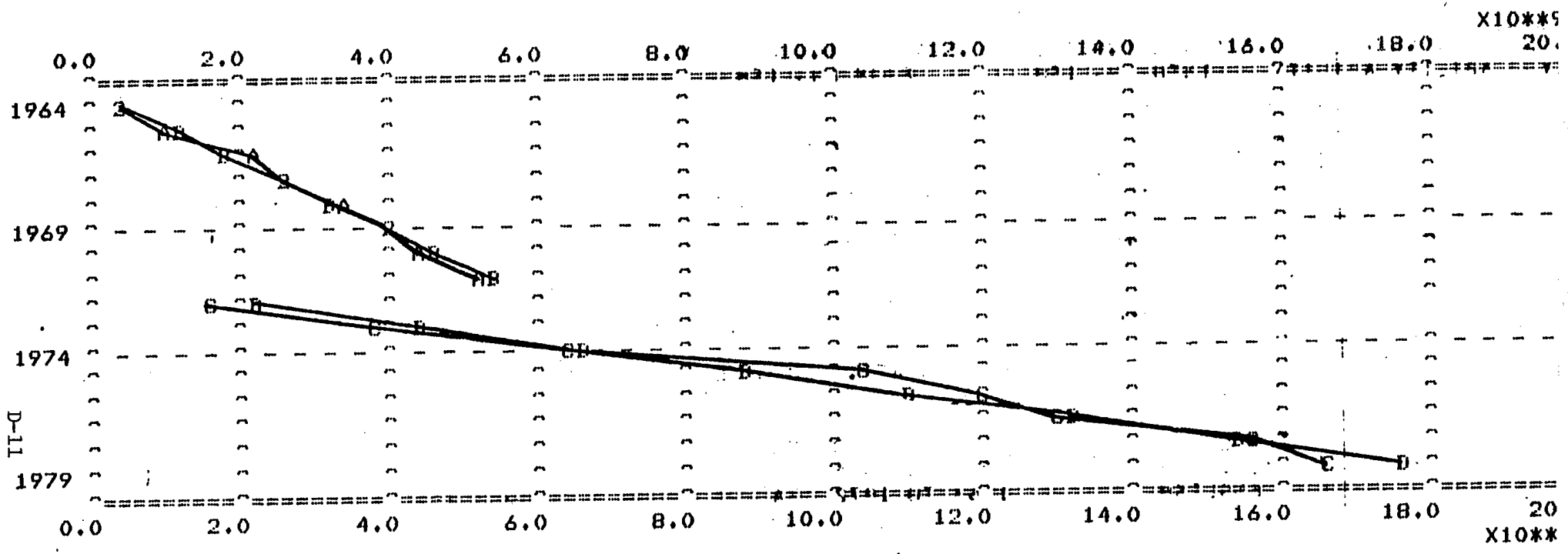
1964	4.871823E+08	1.176170E+09	1.865155E+09	2.554139E+09
1968	3.243123E+09	3.932107E+09	4.621091E+09	5.310079E+09

AIR22FC - DATE REVISED: 9/22/80

ANNUAL DATA FROM 1972 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 28
IN MODEL COMMODFC

DATA

1972	2.180193E+09	4.396540E+09	6.612890E+09	8.829239E+09
1976	1.104559E+10	1.326194E+10	1.547829E+10	1.769464E+10



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMAIR11
B	#1	AIR11FC
C	#1	CUMAIR22
D	#1	AIR22FC

****

3: CUMMIS1 = A1+A2*TIM

NOB = 9 NOVAR = 2
RANGE = 1964 TO 1972
RSQ = 0.98801 CRSQ = 0.9863 F(1/7) = 576.812
SER = 3.61E+07 SSR = 9.124E+15 DW(0) = 2.13

COEF	VALUE	ST ER	T-STAT
A1	-9.71730E+08	8.93719E+07	-10.87290
A2	1.11941E+08	4.66094E+06	24.01680

DATE	LHS	RHS	RESIDUAL
1964	7.268979E+08	7.073861E+08	1.951181E+07
1965	8.016596E+08	8.193272E+08	-1.766758E+07
1966	9.234624E+08	9.312681E+08	-7.805696E+06
1967	9.917041E+08	1.043209E+09	-5.150515E+07
1968	1.199768E+09	1.155150E+09	4.461798E+07
1969	1.305860E+09	1.267091E+09	3.876813E+07
1970	1.390163E+09	1.379033E+09	1.113037E+07
1971	1.445861E+09	1.490973E+09	-4.511232E+07
1972	1.610973E+09	1.602915E+09	8.058880E+06

4: CUMMIS2 = A1+A2*TIMPD

NOB = 7 NOVAR = 2
RANGE = 1973 TO 1979
RSQ = 0.99469 CRSQ = 0.99363 F(1/5) = 936.982
SER = 9.66E+07 SSR = 4.666E+16 DW(0) = 1.68

COEF	VALUE	ST ER	T-STAT
A1	-1.71269E+08	8.16434E+07	-2.09777
A2	5.58820E+08	1.82560E+07	30.61020

DATE	LHS	RHS	RESIDUAL
1973	4.174602E+08	3.875502E+08	2.991002E+07
1974	8.360556E+08	9.463698E+08	-1.103142E+08
1975	1.459172E+09	1.505189E+09	-4.601728E+07
1976	2.204851E+09	2.064009E+09	1.408420E+08
1977	2.681990E+09	2.622829E+09	5.916134E+07
1978	3.196988E+09	3.181648E+09	1.533952E+07
1979	3.651550E+09	3.740468E+09	-8.891750E+07

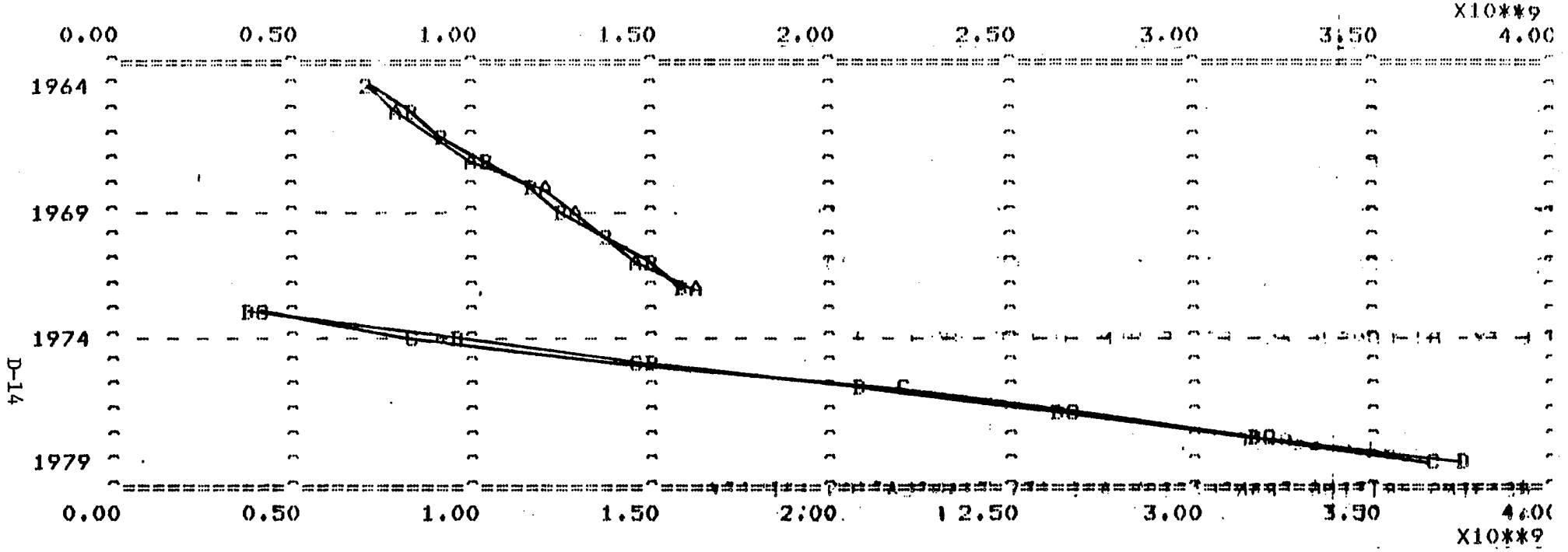
```
CUMI1FC - DATE REVISED:  9/22/80
*
    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 3
 IN MODEL COMMODFC

    DATA
      1964        7.073861E+08  8.193272E+08  9.312681E+08  1.043209E+09
      1968        1.155150E+09  1.267091E+09  1.379033E+09  1.490973E+09
      1972        1.602915E+09

CUMI2FC - DATE REVISED:  9/22/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 4
 IN MODEL COMMODFC

    DATA
      1973        3.875502E+08  9.463698E+08  1.505189E+09  2.064009E+09
      1977        2.622829E+09  3.181648E+09  3.740468E+09
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMMIS1
B	#1	CUMI1FC
C	#1	CUMMIS2
D	#1	CUMI2FC

23: CUMSHIP1 = A1+A2*TIM

NOB = 9 NOVAR = 2
RANGE = 1964 TO 1972
RSQ = 0.98569 CRSQ = 0.98365 F(1/7) = 482.213
SER = 3.82E+07 SSR = 1.024E+16 DW(0) = 1.50

COEF	VALUE	ST ER	T-STAT
A1	-1.40767E+09	9.46743E+07	-14.86850
A2	1.08424E+08	4.93748E+06	21.95930

DATE	LHS	RHS	RESIDUAL
1964	1.676888E+08	2.186852E+08	-5.099640E+07
1965	3.387013E+08	3.271089E+08	1.159245E+07
1966	4.415972E+08	4.355323E+08	6.064896E+06
1967	6.192200E+08	5.439560E+08	7.526400E+07
1968	6.675164E+08	6.523796E+08	1.513677E+07
1969	7.260746E+08	7.608033E+08	-3.472870E+07
1970	8.524974E+08	8.692270E+08	-1.672960E+07
1971	9.688568E+08	9.776507E+08	-8.793856E+06
1972	1.089263E+09	1.086074E+09	3.188480E+06

24: CUMSHIP2 = A1+A2*TIMPD

NOB = 7 NOVAR = 2
RANGE = 1973 TO 1979
RSQ = 0.95507 CRSQ = 0.94609 F(1/5) = 106.296
SER = 1.70E+08 SSR = 1.439E+17 DW(0) = 1.04

COEF	VALUE	ST ER	T-STAT
A1	-1.01593E+08	1.43382E+08	-0.70855
A2	3.30550E+08	3.20611E+07	10.31000

DATE	LHS	RHS	RESIDUAL
1973	8.133131E+07	2.289564E+08	-1.476251E+08
1974	4.586668E+08	5.595057E+08	-1.008389E+08
1975	1.070956E+09	8.900552E+08	1.809009E+08
1976	1.343888E+09	1.220605E+09	1.232835E+08
1977	1.696048E+09	1.551154E+09	1.448940E+08
1978	1.888420E+09	1.881704E+09	6.716416E+06
1979	2.004929E+09	2.212253E+09	-2.073244E+08

```
SHP1FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 23
 IN MODEL COMMODFC

    DATA
      1964       2.186852E+08  3.271089E+08  4.355323E+08  5.439560E+08
      1968       6.523796E+08  7.608033E+08  8.692270E+08  9.776507E+08
      1972       1.086074E+09

SHP2FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 24
 IN MODEL COMMODFC

    DATA
      1973       2.289564E+08  5.595057E+08  8.900552E+08  1.220605E+09
      1977       1.551154E+09  1.881704E+09  2.212253E+09
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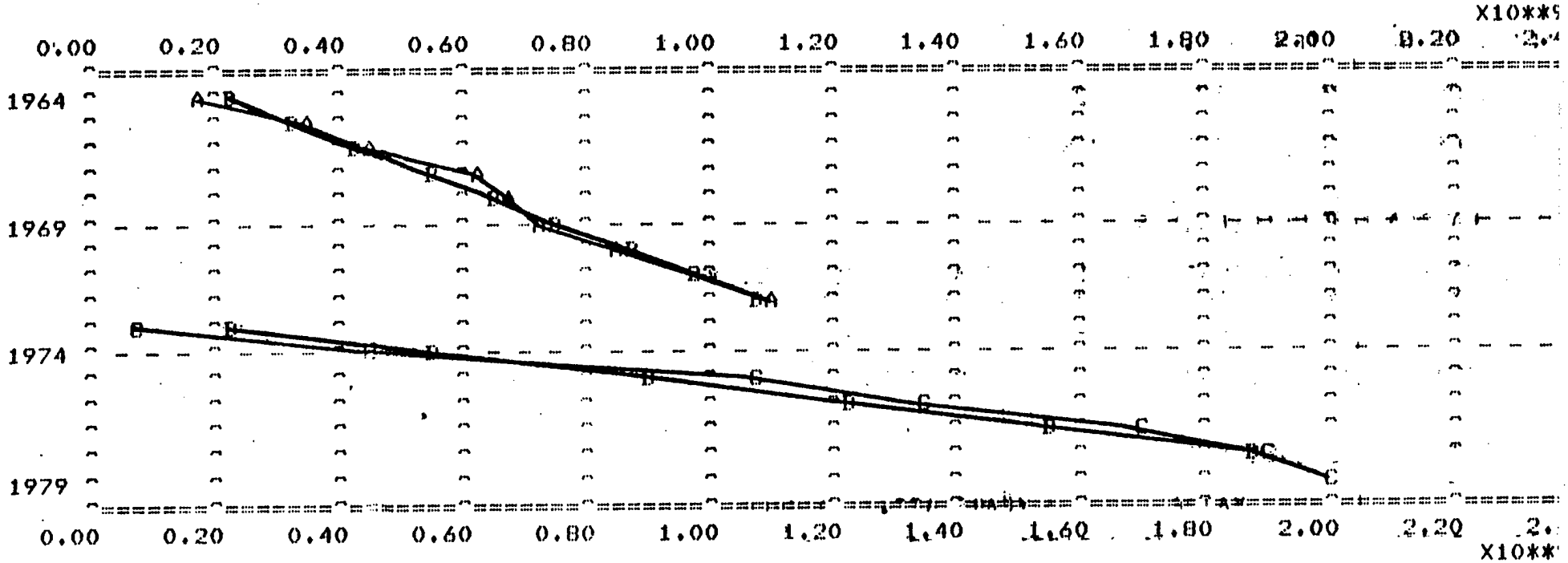


**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMSHIP1
B	#1	SHP1FC
C	#1	CUMSHIP2
D	#1	SHP2FC

****

45: CUMCV1 = A1+A2*TIM

NOB = 9 NOVAR = 2
RANGE = 1964 TO 1972
RSQ = 0.97759 CRSQ = 0.97439 F(1/7) = 305.336
SER = 4.62E+07 SSR = 1.495E+16 DW(0) = 1.61

COEF	VALUE	ST ER	T-STAT
A1	-1.29085E+09	1.14384E+08	-11.28520
A2	1.04238E+08	5.96540E+06	17.47380

DATE	LHS	RHS	RESIDUAL
1964	2.229277E+08	2.727299E+08	-4.980214E+07
1965	4.243031E+08	3.769684E+08	4.733466E+07
1966	5.141176E+08	4.812068E+08	3.291085E+07
1967	6.025175E+08	5.854451E+08	1.707238E+07
1968	6.806940E+08	6.896835E+08	-8.989440E+06
1969	7.879798E+08	7.939218E+08	-5.942016E+06
1970	8.213089E+08	8.981601E+08	-7.685120E+07
1971	9.941281E+08	1.002399E+09	-8.270592E+06
1972	1.159173E+09	1.106637E+09	5.253632E+07

46: CUMCV2 = A1+A2*TIMPD

NOB = 7 NOVAR = 2
RANGE = 1973 TO 1979
RSQ = 0.95102 CRSQ = 0.94123 F(1/5) = 97.092
SER = 1.43E+08 SSR = 1.020E+17 DW(0) = 1.54

COEF	VALUE	ST ER	T-STAT
A1	1.82267E+07	1.20720E+08	0.15098
A2	2.65983E+08	2.69938E+07	9.85351

DATE	LHS	RHS	RESIDUAL
1973	6.514514E+07	2.842099E+08	-2.190648E+08
1974	6.763300E+08	5.501934E+08	1.261366E+08
1975	9.217393E+08	8.161769E+08	1.055624E+08
1976	1.178461E+09	1.082160E+09	9.630106E+07
1977	1.394252E+09	1.348144E+09	4.610816E+07
1978	1.494470E+09	1.614127E+09	-1.196577E+08
1979	1.844727E+09	1.880111E+09	-3.538381E+07

```
CV1FC - DATE REVISED:  9/23/80

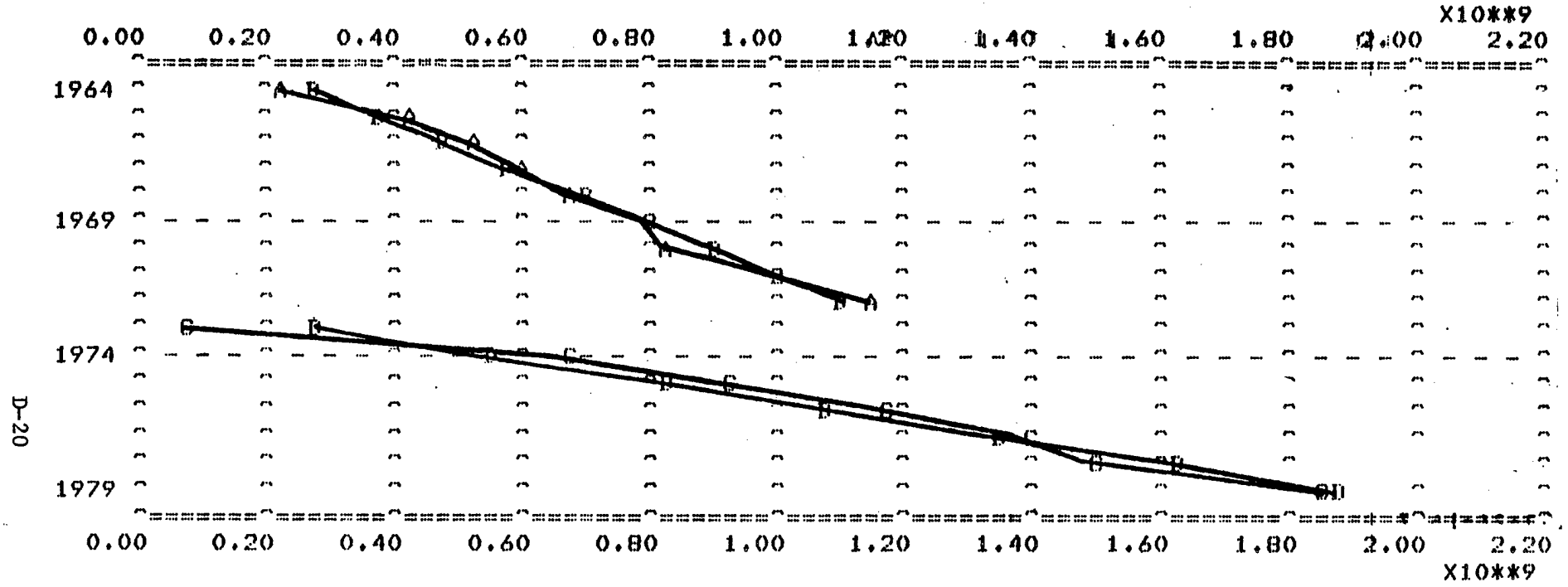
    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 45
 IN MODEL COMMODFC

    DATA
      1964        2.727299E+08  3.769684E+08  4.812068E+08  5.854451E+08
      1968        6.896835E+08  7.939218E+08  8.981601E+08  1.002399E+09
      1972        1.106637E+09

CV2FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 46
 IN MODEL COMMODFC

    DATA
      1973        2.842099E+08  5.501934E+08  8.161769E+08  1.082160E+09
      1977        1.348144E+09  1.614127E+09  1.880111E+09
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMCV1
B	#1	CV1FC
C	#1	CUMCV2
D	#1	CV2FC

5: CUMTACS1 = A1+A2*TIM

NOB = 9 NOVAR = 2
RANGE = 1964 TO 1972
RSQ = 0.99521 CRSQ = 0.99452 F(1/7) = 1453.170
SER = 1.93E+07 SSR = 2.602E+15 DW(0) = 2.55

COEF	VALUE	ST ER	T-STAT
A1	-1.38548E+09	4.77235E+07	-29.03140
A2	9.48773E+07	2.48888E+06	38.12040

DATE	LHS	RHS	RESIDUAL
1964	6.162758E+07	3.767706E+07	2.395053E+07
1965	1.267863E+08	1.325545E+08	-5.768224E+06
1966	2.163038E+08	2.274317E+08	-1.112792E+07
1967	3.189455E+08	3.223089E+08	-3.363328E+06
1968	3.904138E+08	4.171860E+08	-2.677222E+07
1969	5.362506E+08	5.120635E+08	2.418714E+07
1970	5.878249E+08	6.069407E+08	-1.911578E+07
1971	7.069261E+08	7.018179E+08	5.108224E+06
1972	8.095946E+08	7.966953E+08	1.289933E+07

6: CUMTACS2 = A1+A2*TIMPD

NOB = 7 NOVAR = 2
RANGE = 1973 TO 1979
RSQ = 0.87905 CRSQ = 0.85486 F(1/5) = 36.339
SER = 5.40E+07 SSR = 1.460E+16 DW(0) = 1.10

COEF	VALUE	ST ER	T-STAT
A1	8.53575E+07	4.56678E+07	1.86909
A2	6.15573E+07	1.02116E+07	6.02816

DATE	LHS	RHS	RESIDUAL
1973	6.785347E+07	1.469148E+08	-7.906136E+07
1974	2.362870E+08	2.084722E+08	2.781486E+07
1975	3.021153E+08	2.700293E+08	3.208602E+07
1976	3.906255E+08	3.315868E+08	5.903872E+07
1977	4.187786E+08	3.931438E+08	2.563482E+07
1978	4.332667E+08	4.547011E+08	-2.143437E+07
1979	4.721810E+08	5.162586E+08	-4.407757E+07

TACS1FC - DATE REVISED: 9/22/80

ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 5
IN MODEL COMMODFC

DATA

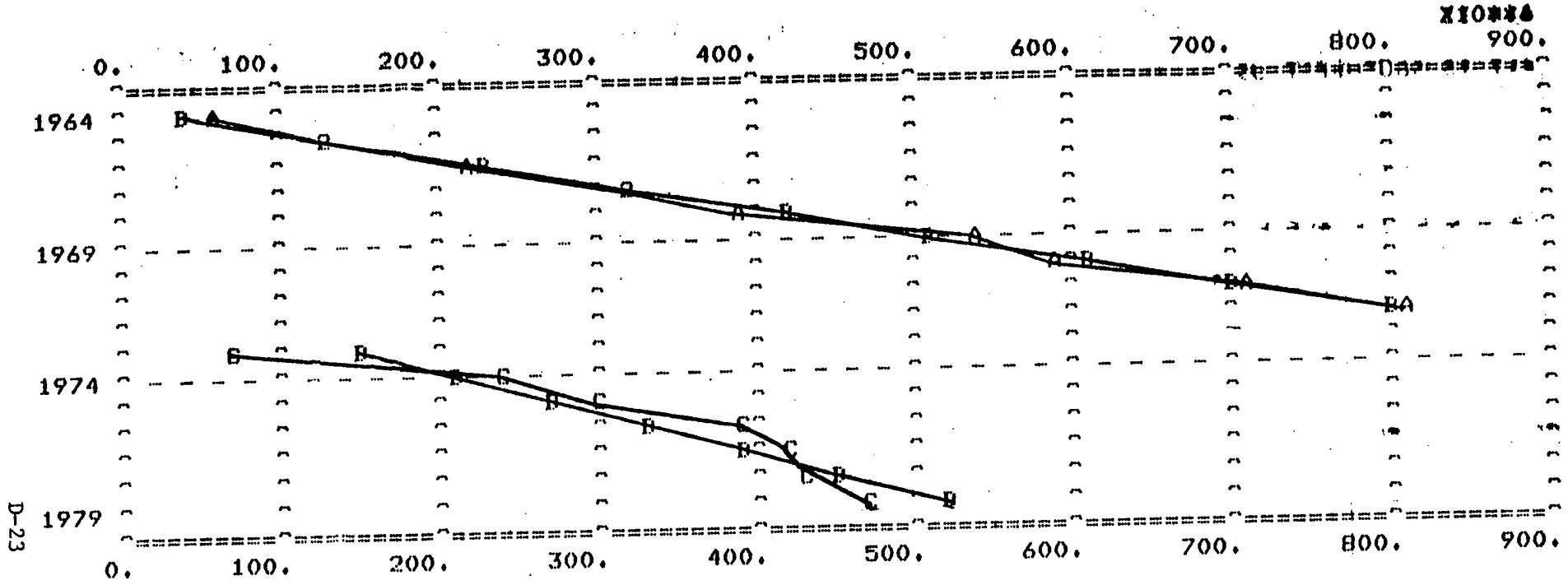
1964	3.767706E+07	1.325545E+08	2.274317E+08	3.223089E+08
1968	4.171860E+08	5.120635E+08	6.069407E+08	7.018179E+08
1972	7.966953E+08			

TACS2FC - DATE REVISED: 9/22/80

ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 6
IN MODEL COMMODFC

DATA

1973	1.469148E+08	2.084722E+08	2.700293E+08	3.315868E+08
1977	3.931438E+08	4.547011E+08	5.162586E+08	



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMTACS1
B	#1	TACS1FC
C	#1	CUMTACS2
D	#1	TACS2FC

****

29: CUMTAC11 = A1+A2*TIM

NOB = 12 NOVAR = 2
RANGE = 1964 TO 1975
RSQ = 0.9958 CRSQ = 0.99538 F(1/10) = 2370.920
SER = 2.40E+07 SSR = 5.742E+15 DW(0) = 2.38

COEF	VALUE	ST ER	T-STAT
A1	-1.43438E+09	4.16568E+07	-34.43340
A2	9.75704E+07	2.00383E+06	48.69200

DATE	LHS	RHS	RESIDUAL
1964	6.162758E+07	2.917197E+07	3.245562E+07
1965	1.267863E+08	1.267425E+08	43744.
1966	2.163038E+08	2.243128E+08	-8.009072E+06
1967	3.189455E+08	3.218831E+08	-2.937600E+06
1968	3.904138E+08	4.194534E+08	-2.903962E+07
1969	5.362506E+08	5.170240E+08	1.922662E+07
1970	5.878249E+08	6.145943E+08	-2.676941E+07
1971	7.069261E+08	7.121646E+08	-5.238528E+06
1972	8.095946E+08	8.097349E+08	-140288.
1973	8.774479E+08	9.073055E+08	-2.985754E+07
1974	1.045881E+09	1.004876E+09	4.100557E+07
1975	1.111710E+09	1.102446E+09	9.263616E+06

30: CUMTAC22 = A1+A2*TIMPDX2

NOB = 4 NOVAR = 2
RANGE = 1976 TO 1979
RSQ = 0.97066 CRSQ = 0.95599 F(1/2) = 66.171
SER = 7.12E+06 SSR = 1.015E+14 DW(0) = 3.00

COEF	VALUE	ST ER	T-STAT
A1	6.18089E+07	8.72487E+06	7.08422
A2	2.59156E+07	3.18587E+06	8.13452

DATE	LHS	RHS	RESIDUAL
1976	8.851024E+07	8.772446E+07	785776.
1977	1.166634E+08	1.136400E+08	3.023376E+06
1978	1.311516E+08	1.395556E+08	-8.403952E+06
1979	1.700660E+08	1.654711E+08	4.594912E+06

TAC1FC - DATE REVISED: 9/23/80

ANNUAL DATA FROM 1964 TO 1975
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 29
IN MODEL COMMODFC

DATA

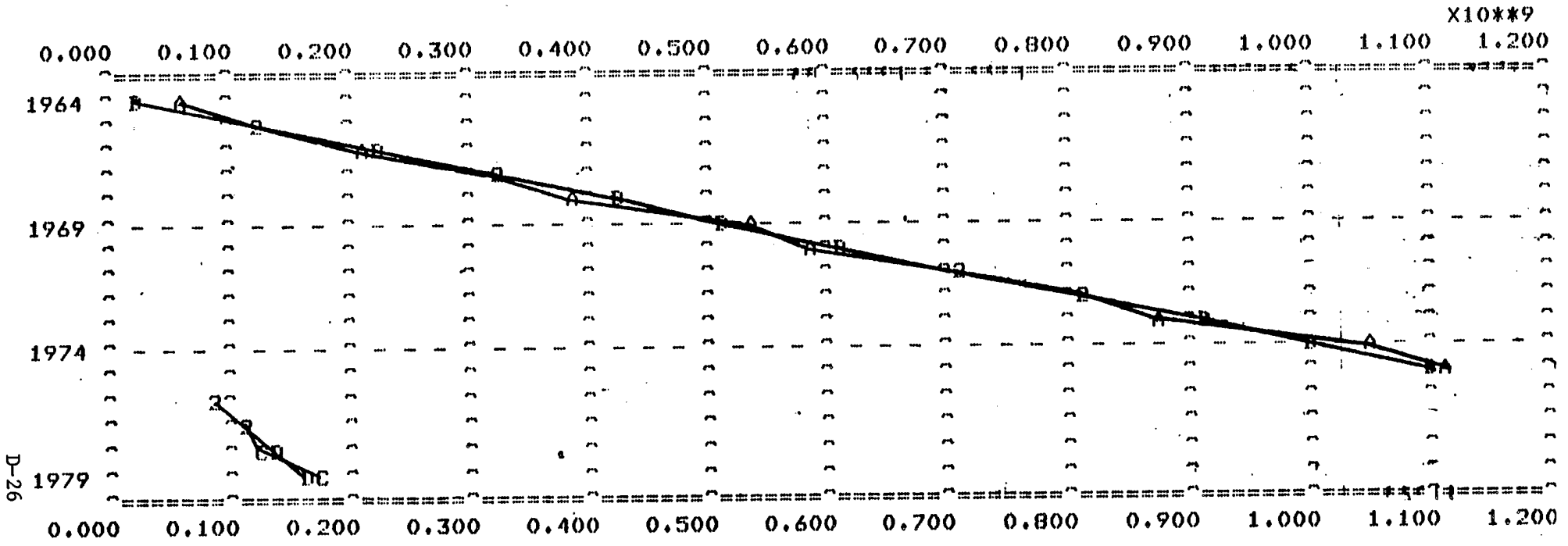
1964	2.917197E+07	1.267425E+08	2.243128E+08	3.218831E+08
1968	4.194534E+08	5.170240E+08	6.145943E+08	7.121646E+08
1972	8.097349E+08	9.073055E+08	1.004876E+09	1.102446E+09

TAC2FC - DATE REVISED: 9/23/80

ANNUAL DATA FROM 1976 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 30
IN MODEL COMMODFC

DATA

1976	8.772446E+07	1.136400E+08	1.395556E+08	1.654711E+08



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMTAC11
B	#1	TAC1FC
C	#1	CUMTAC22
D	#1	TAC2FC

****

7: CUMWEAP1 = A1+A2*TIM

NOB = 9 NOVAR = 2
RANGE = 1964 TO 1972
RSQ = 0.98266 CRSQ = 0.98019 F(1/7) = 396.800
SER = 3.52E+07 SSR = 8.658E+15 DW(0) = 0.87

COEF	VALUE	ST ER	T-STAT
A1	-1.34445E+09	8.70586E+07	-15.44300
A2	9.04420E+07	4.54030E+06	19.91980

DATE	LHS	RHS	RESIDUAL
1964	6.144666E+07	1.218534E+07	4.926131E+07
1965	1.087842E+08	1.026276E+08	6.156608E+06
1966	1.919220E+08	1.930696E+08	-1.147600E+06
1967	2.376520E+08	2.835116E+08	-4.585958E+07
1968	3.208284E+08	3.739535E+08	-5.312512E+07
1969	4.655841E+08	4.643958E+08	1.188352E+06
1970	5.513449E+08	5.548378E+08	-3.492864E+06
1971	6.601905E+08	6.452797E+08	1.491072E+07
1972	7.678280E+08	7.357217E+08	3.210624E+07

8: CUMWEAP2 = A1+A2*TIMPD

NOB = 7 NOVAR = 2
RANGE = 1973 TO 1979
RSQ = 0.98152 CRSQ = 0.97782 F(1/5) = 265.564
SER = 3.39E+07 SSR = 5.738E+15 DW(0) = 1.56

COEF	VALUE	ST ER	T-STAT
A1	2.52306E+06	2.86305E+07	0.08812
A2	1.04327E+08	6.40197E+06	16.29610

DATE	LHS	RHS	RESIDUAL
1973	8.856496E+07	1.068503E+08	-1.828534E+07
1974	1.861269E+08	2.111776E+08	-2.505067E+07
1975	3.451653E+08	3.155044E+08	2.966093E+07
1976	4.638446E+08	4.198318E+08	4.401280E+07
1977	5.374077E+08	5.241590E+08	1.324877E+07
1978	5.862756E+08	6.284861E+08	-4.221056E+07
1979	7.314394E+08	7.328136E+08	-1.374208E+06

WEAP1FC - DATE REVISED: 9/22/80

ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 7
IN MODEL COMMODFC

DATA

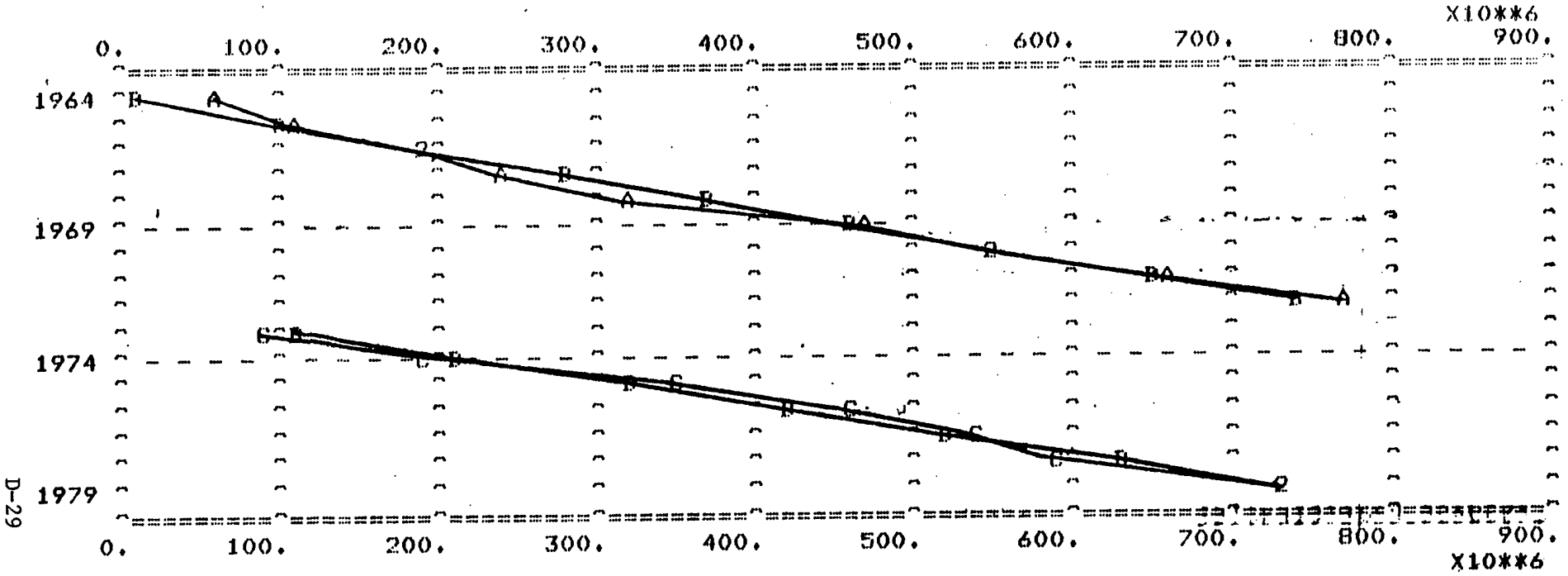
1964	1.218534E+07	1.026276E+08	1.930696E+08	2.835116E+08
1968	3.739535E+08	4.643958E+08	5.548378E+08	6.452797E+08
1972	7.357217E+08			

WEAP2FC - DATE REVISED: 9/22/80

ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 8
IN MODEL COMMODFC

DATA

1973	1.068503E+08	2.111776E+08	3.155044E+08	4.198318E+08
1977	5.241590E+08	6.284861E+08	7.328136E+08	



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMWEAP1
B	#1	WEAP1FC
C	#1	CUMWEAP2
D	#1	WEAP2FC

****

9: CUMAMMO1 = A1+A2*TIM

NOB = 9 NOVAR = 2
RANGE = 1964 TO 1972
RSQ = 0.95593 CRSQ = 0.94963 F(1/7) = 151.821
SER = 3.71E+08 SSR = 9.635E+17 DW(0) = 0.55

COEF	VALUE	ST ER	T-STAT
A1	-9.18726E+09	9.18403E+08	-10.00350
A2	5.90163E+08	4.78968E+07	12.32160

DATE	LHS	RHS	RESIDUAL
1964	1.858341E+08	-3.348111E+08	5.206451E+08
1965	3.573366E+08	2.553528E+08	1.019837E+08
1966	7.625313E+08	8.455127E+08	-8.298138E+07
1967	1.090521E+09	1.435677E+09	-3.451556E+08
1968	1.641864E+09	2.025841E+09	-3.839764E+08
1969	2.280571E+09	2.616005E+09	-3.354340E+08
1970	3.072230E+09	3.206169E+09	-1.339389E+08
1971	3.950960E+09	3.796328E+09	1.546312E+08
1972	4.890702E+09	4.386492E+09	5.042094E+08

10: CUMAMMO2 = A1+A2*TIMPD

NOB = 7 NOVAR = 2
RANGE = 1973 TO 1979
RSQ = 0.9261 CRSQ = 0.91132 F(1/5) = 62.660
SER = 2.53E+08 SSR = 3.206E+17 DW(0) = 0.96

COEF	VALUE	ST ER	T-STAT
A1	1.20123E+09	2.14002E+08	5.61318
A2	3.78789E+08	4.78523E+07	7.91581

DATE	LHS	RHS	RESIDUAL
1973	1.220285E+09	1.580020E+09	-3.597353E+08
1974	2.005721E+09	1.958810E+09	4.691149E+07
1975	2.652122E+09	2.337599E+09	3.145229E+08
1976	2.902216E+09	2.716389E+09	1.858271E+08
1977	3.178075E+09	3.095178E+09	8.289690E+07
1978	3.416459E+09	3.473967E+09	-5.750861E+07
1979	3.639844E+09	3.852757E+09	-2.129126E+08

```
AMM01FC - DATE REVISED:  9/22/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 9
 IN MODEL COMMODFC

    DATA
      1964       -3.348111E+08  2.553528E+08  8.455127E+08  1.435677E+09
      1968        2.025841E+09  2.616005E+09  3.206169E+09  3.796328E+09
      1972        4.386492E+09

AMM02FC - DATE REVISED:  9/22/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 10
 IN MODEL COMMODFC

    DATA
      1973        1.580020E+09  1.958810E+09  2.337599E+09  2.716389E+09
      1977        3.095178E+09  3.473967E+09  3.852757E+09
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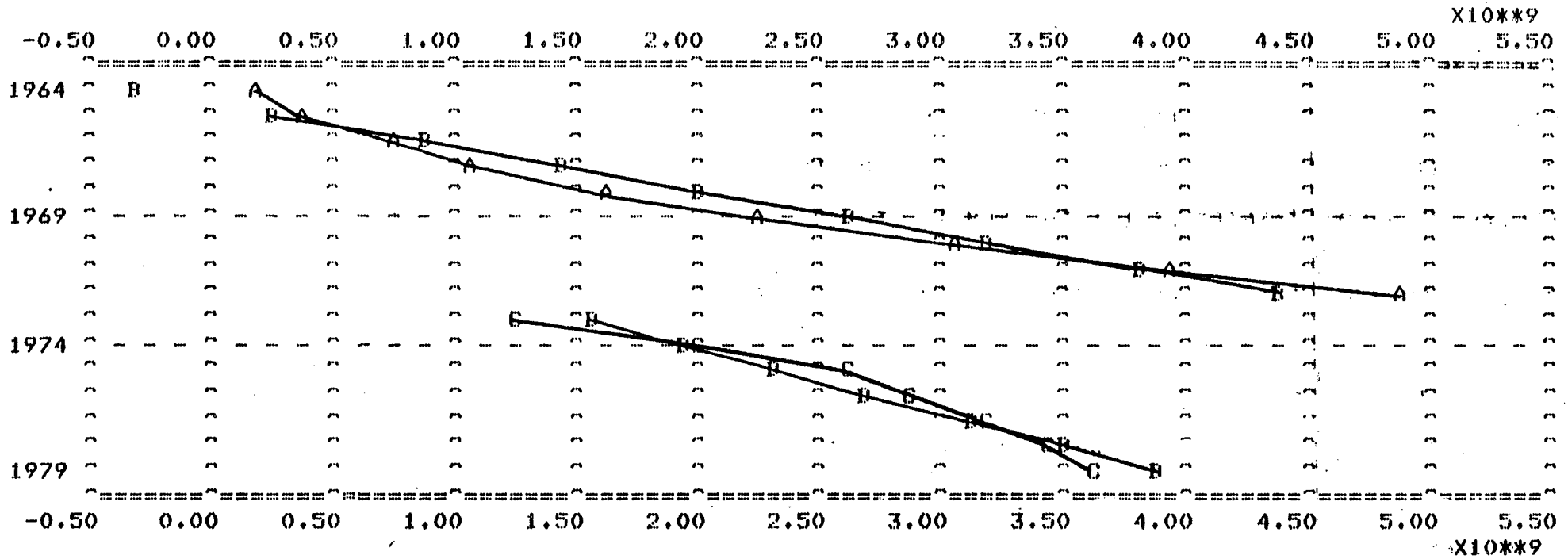


**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMAMM01
B	#1	AMM01FC
C	#1	CUMAMM02
D	#1	AMM02FC

****

31: CUMAMM11 = A1+A2*TIM

NOB = 12 NOVAR = 2
RANGE = 1964 TO 1975
RSQ = 0.9662 CRSQ = 0.96282 F(1/10) = 285.877
SER = 5.04E+08 SSR = 2.543E+18 DW(0) = 0.36

COEF	VALUE	ST ER	T-STAT
A1	-1.13860E+10	8.76732E+08	-12.98690
A2	7.13068E+08	4.21736E+07	16.90790

DATE	LHS	RHS	RESIDUAL
1964	1.858341E+08	-6.899835E+08	8.758175E+08
1965	3.573366E+08	2.308506E+07	3.342515E+08
1966	7.625313E+08	7.361495E+08	2.638182E+07
1967	1.090521E+09	1.449218E+09	-3.586970E+08
1968	1.641864E+09	2.162287E+09	-5.204224E+08
1969	2.280571E+09	2.875355E+09	-5.947845E+08
1970	3.072230E+09	3.588424E+09	-5.161940E+08
1971	3.950960E+09	4.301492E+09	-3.505326E+08
1972	4.890702E+09	5.014561E+09	-1.238589E+08
1973	6.110986E+09	5.727629E+09	3.833569E+08
1974	6.896419E+09	6.440698E+09	4.557210E+08
1975	7.542817E+09	7.153766E+09	3.890504E+08

32: CUMAMM22 = A1+A2*TIMPDX3

NOB = 4 NOVAR = 2
RANGE = 1976 TO 1979
RSQ = 0.99763 CRSQ = 0.99645 F(1/2) = 841.981
SER = 1.89E+07 SSR = 7.136E+14 DW(0) = 2.05

COEF	VALUE	ST ER	T-STAT
A1	1.92091E+07	2.31351E+07	0.83030
A2	2.45127E+08	8.44774E+06	29.01680

DATE	LHS	RHS	RESIDUAL
1976	2.500937E+08	2.643360E+08	-1.424227E+07
1977	5.259528E+08	5.094625E+08	1.649024E+07
1978	7.643366E+08	7.545894E+08	9.747200E+06
1979	9.877220E+08	9.997164E+08	-1.199437E+07

~~CUMAMM11 - DATE REVISED: 9/22/80~~

ANNUAL DATA FROM 1964 TO 1975
COMMENT:
CUMAMM11 = CUMSUM(SAF1_AMMO)

DATA

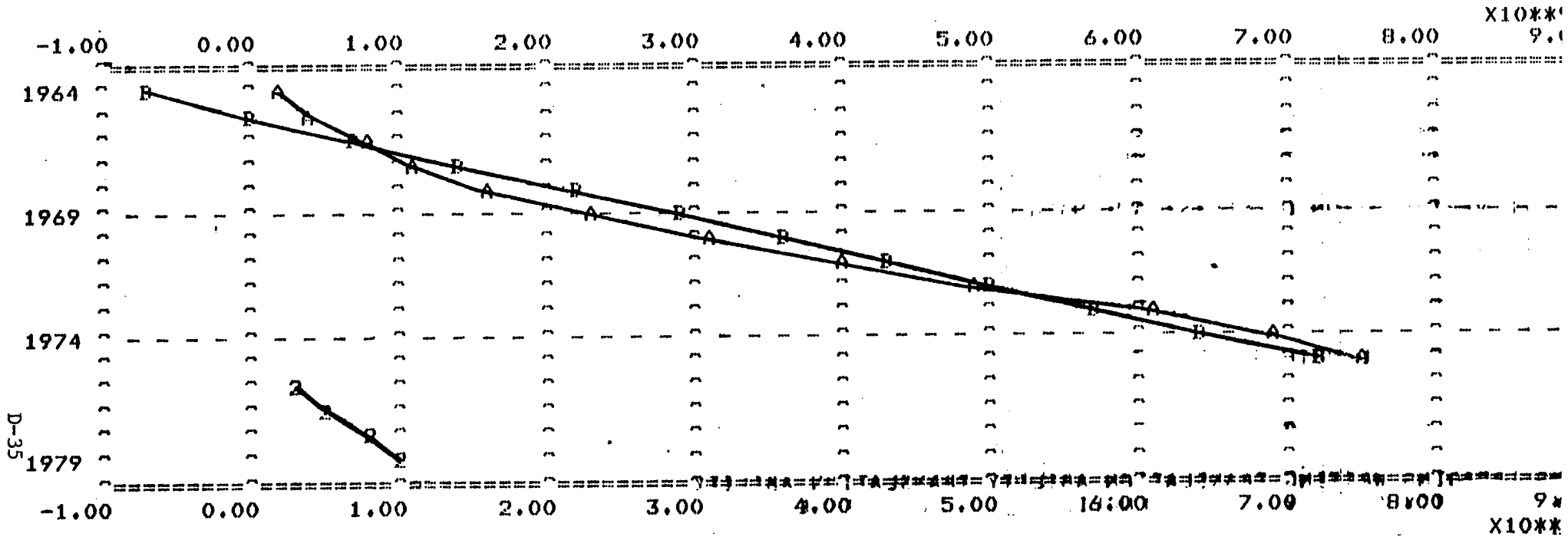
1964	1.858341E+08	3.573366E+08	7.625313E+08	1.090521E+09
1968	1.641864E+09	2.280571E+09	3.072230E+09	3.950960E+09
1972	4.890702E+09	6.110986E+09	6.896419E+09	7.542817E+09

CUMAMM22 - DATE REVISED: 9/22/80

ANNUAL DATA FROM 1976 TO 1980
COMMENT:
CUMAMM22 = CUMSUM(SAF1_AMMO)

DATA

1976	2.500937E+08	5.259528E+08	7.643366E+08	9.877220E+08
1980	1.070313E+09			



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMAMM11
B	#1	CAM11FC
C	#1	CUMAMM22
D	#1	CAM22FC

****

11: CUMCOM1 = A1+A2*TIM

NOB = 9 NOVAR = 2
RANGE = 1964 TO 1972
RSQ = 0.99212 CRSQ = 0.99099 F(1/7) = 881.075
SER = 3.50E+07 SSR = 8.575E+15 DW(0) = 1.16

COEF	VALUE	ST ER	T-STAT
A1	-1.94774E+09	8.66390E+07	-22.48110
A2	1.34120E+08	4.51841E+06	29.68290

DATE	LHS	RHS	RESIDUAL
1964	1.110763E+08	6.405146E+07	4.702488E+07
1965	1.958700E+08	1.981711E+08	-2.301184E+06
1966	3.298204E+08	3.322906E+08	-2.470144E+06
1967	4.462502E+08	4.664102E+08	-2.016000E+07
1968	5.681887E+08	6.005299E+08	-3.234125E+07
1969	7.023780E+08	7.346496E+08	-3.227162E+07
1970	8.678380E+08	8.687693E+08	-931328.
1971	9.864445E+08	1.002889E+09	-1.644442E+07
1972	1.196899E+09	1.137009E+09	5.989069E+07

12: CUMCOM2 = A1+A2*TIMPD

NOB = 7 NOVAR = 2
RANGE = 1973 TO 1979
RSQ = 0.98411 CRSQ = 0.98093 F(1/5) = 309.580
SER = 3.46E+07 SSR = 5.993E+15 DW(0) = 2.11

COEF	VALUE	ST ER	T-STAT
A1	4.53356E+07	2.92610E+07	1.54935
A2	1.15122E+08	6.54296E+06	17.59480

DATE	LHS	RHS	RESIDUAL
1973	1.432381E+08	1.604580E+08	-1.721986E+07
1974	3.100695E+08	2.755804E+08	3.448909E+07
1975	3.929416E+08	3.907026E+08	2.238976E+06
1976	5.113871E+08	5.058250E+08	5.562112E+06
1977	5.952218E+08	6.209475E+08	-2.572570E+07
1978	6.927549E+08	7.360699E+08	-4.331494E+07
1979	8.951636E+08	8.511923E+08	4.397133E+07

```
COM1FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 11
 IN MODEL COMMODFC

    DATA
      1964        6.405146E+07  1.981711E+08  3.322906E+08  4.664102E+08
      1968        6.005299E+08  7.346496E+08  8.687693E+08  1.002889E+09
      1972        1.137009E+09

COM2FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 12
 IN MODEL COMMODFC

    DATA
      1973        1.604580E+08  2.755804E+08  3.907026E+08  5.058250E+08
      1977        6.209475E+08  7.360699E+08  8.511923E+08
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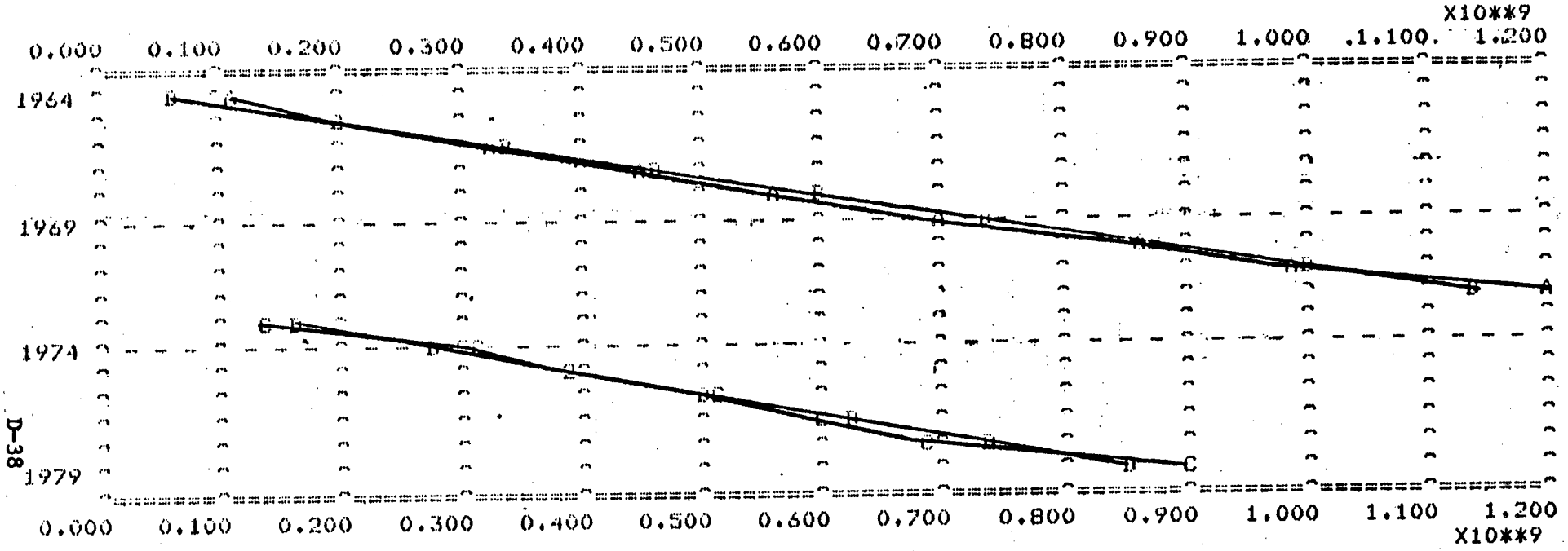

**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMCOM1
B	#1	COM1FC
C	#1	CUMCOM2
D	#1	COM2FC

****

33: CUMCOM11 = A1+A2*TIM

NOB = 11 NOVAR = 2
RANGE = 1964 TO 1974
RSQ = 0.99302 CRSQ = 0.99224 F(1/9) = 1279.540
SER = 4.14E+07 SSR = 1.544E+16 DW(0) = 0.70

COEF	VALUE	ST ER	T-STAT
A1	-2.07489E+09	7.99580E+07	-25.94970
A2	1.41253E+08	3.94885E+06	35.77060

DATE	LHS	RHS	RESIDUAL
1964	1.110763E+08	4.390630E+07	6.717003E+07
1965	1.958700E+08	1.851592E+08	1.071078E+07
1966	3.298204E+08	3.264118E+08	3.408640E+06
1967	4.462502E+08	4.676646E+08	-2.141440E+07
1968	5.681887E+08	6.089175E+08	-4.072883E+07
1969	7.023780E+08	7.501704E+08	-4.779238E+07
1970	8.678380E+08	8.914230E+08	-2.358502E+07
1971	9.864445E+08	1.032676E+09	-4.623130E+07
1972	1.196899E+09	1.173929E+09	2.297062E+07
1973	1.340137E+09	1.315182E+09	2.495590E+07
1974	1.506969E+09	1.456434E+09	5.053466E+07

34: CUMCOM22 = A1+A2*TIMPDX4

NOB = 5 NOVAR = 2
RANGE = 1975 TO 1979
RSQ = 0.97014 CRSQ = 0.96019 F(1/3) = 97.466
SER = 3.80E+07 SSR = 4.328E+15 DW(0) = 2.00

COEF	VALUE	ST ER	T-STAT
A1	-4.83191E+07	3.98369E+07	-1.21292
A2	1.18581E+08	1.20113E+07	9.87247

DATE	LHS	RHS	RESIDUAL
1975	8.287219E+07	7.026211E+07	1.261008E+07
1976	2.013179E+08	1.888433E+08	1.247459E+07
1977	2.851525E+08	3.074243E+08	-2.227174E+07
1978	3.826857E+08	4.260055E+08	-4.331981E+07
1979	5.850944E+08	5.445868E+08	4.050765E+07

```
CCOM1FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1964 TO 1974
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 33
 IN MODEL COMMODFC

    DATA
      1964        4.390630E+07  1.851592E+08  3.264118E+08  4.676646E+08
      1968        6.089175E+08  7.501704E+08  8.914230E+08  1.032476E+09
      1972        1.173929E+09  1.315182E+09  1.456434E+09

CCOM2FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1975 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 34
 IN MODEL COMMODFC

    DATA
      1975        7.026211E+07  1.888433E+08  3.074243E+08  4.260055E+08
      1979        5.445868E+08
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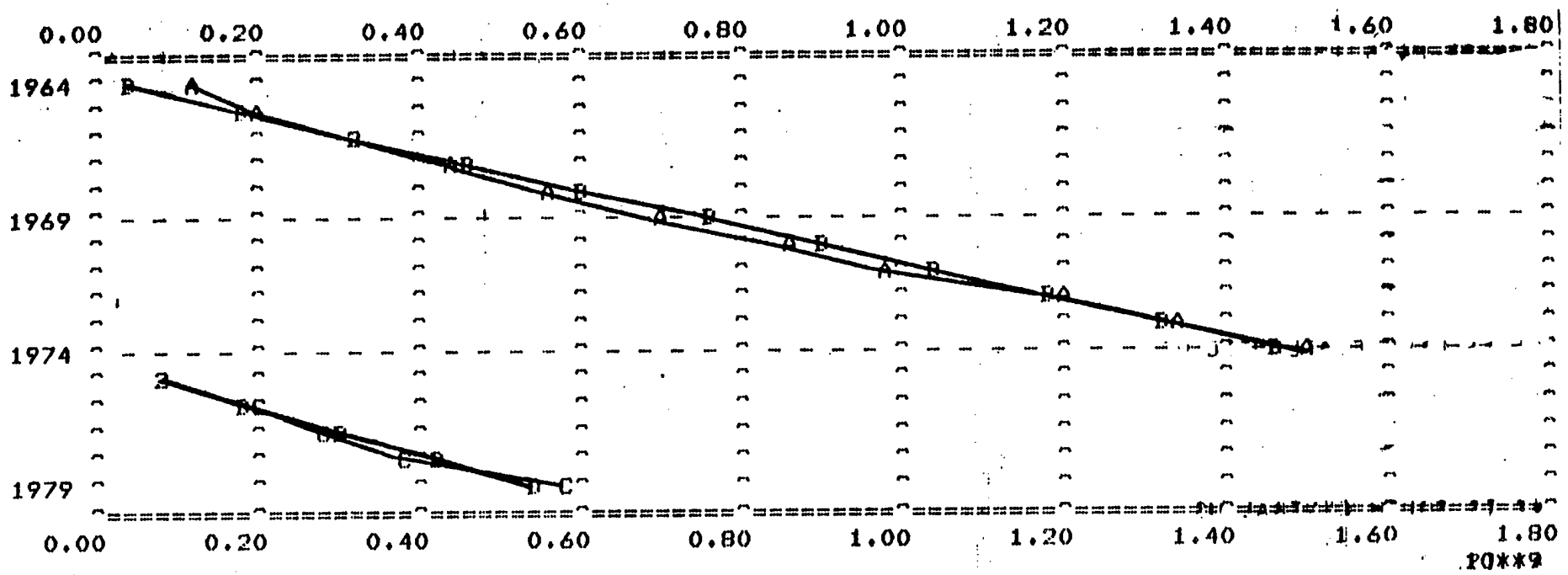

**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMCOM11
B	#1	CCOM1FC
C	#1	CUMCOM22
D	#1	CCOM2FC

****

```
13:  CUMSPT1 = A1+A2*TIM


NOB = 9      NOVAR = 2
RANGE =  1964 TO 1972
RSQ =   0.99264      CRSQ =   0.99159      F(1/7) =   944.181
SER = 3.32E+07       SSR = 7.731E+15       DW(0) =  1.90

COEF            VALUE           ST ER          T-STAT

A1        -1.91356E+09     8.22672E+07      -23.26030
A2         1.31834E+08     4.29042E+06       30.72750


 DATE           LHS             RHS           RESIDUAL

1964        9.260488E+07    6.394906E+07    2.865582E+07
1965        1.801498E+08    1.957832E+08   -1.563334E+07
1966        3.182669E+08    3.276170E+08   -9.350144E+06
1967        4.691768E+08    4.594509E+08    9.725952E+06
1968        5.845701E+08    5.912847E+08   -6.714624E+06
1969        7.304988E+08    7.231186E+08    7.380224E+06
1970        8.214618E+08    8.549524E+08   -3.349069E+07
1971        9.461302E+08    9.867863E+08   -4.065613E+07
1972        1.178700E+09    1.118620E+09    6.007962E+07


%14:  CUMSPT2 = A1+A2*TIMPD


NOB = 7      NOVAR = 2
RANGE =  1973 TO 1979
RSQ =   0.99413      CRSQ =   0.99295      F(1/5) =   846.527
SER = 3.52E+07       SSR = 6.195E+15       DW(0) =  2.67

COEF            VALUE           ST ER          T-STAT

A1         1.32026E+07     2.97480E+07       0.44381
A2         1.93537E+08     6.65187E+06      29.09510


 DATE           LHS             RHS           RESIDUAL

1973        2.247182E+08    2.067394E+08    1.797880E+07
1974        3.809876E+08    4.002760E+08   -1.928832E+07
1975        6.145111E+08    5.938127E+08    2.069837E+07
1976        7.877760E+08    7.873495E+08    426496.
1977        9.178391E+08    9.808863E+08   -6.304717E+07
1978        1.205018E+09    1.174423E+09    3.059507E+07
1979        1.380599E+09    1.367960E+09    1.263898E+07
```

```
SPT1FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 13
 IN MODEL COMMODFC

    DATA
      1964       6.394906E+07  1.957832E+08  3.276170E+08  4.594509E+08
      1968       5.912847E+08  7.231186E+08  8.549524E+08  9.867863E+08
      1972       1.118620E+09

SPT2FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 14
 IN MODEL COMMODFC

    DATA
      1973       2.067394E+08  4.002760E+08  5.938127E+08  7.873495E+08
      1977       9.808863E+08  1.174423E+09  1.367960E+09
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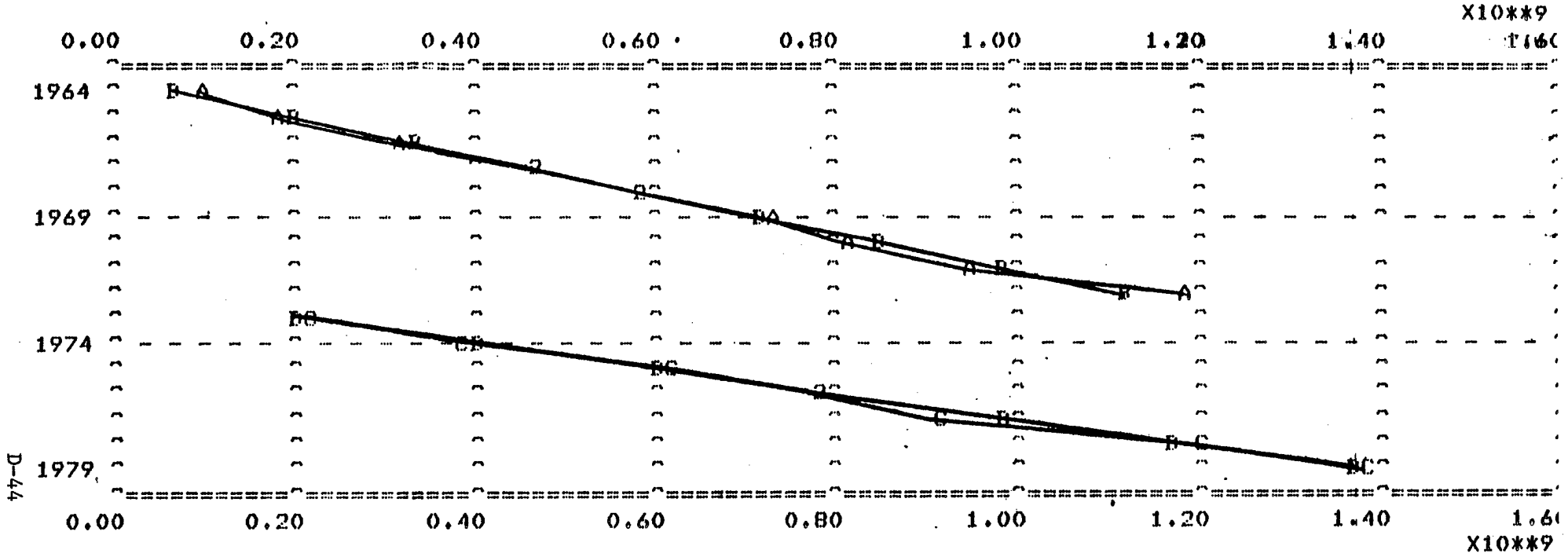

**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMSPT1
B	#1	SPT1FC
C	#1	CUMSPT2
D	#1	SPT2FC

****

15: CUMSUP1 = A1+A2*TIM

NOB = 9 NOVAR = 2
RANGE = 1964 TO 1972
RSQ = 0.99288 CRSQ = 0.99187 F(1/7) = 976.422
SER = 6.61E+07 SSR = 3.058E+16 DW(0) = 0.88

COEF	VALUE	ST ER	T-STAT
A1	-3.91038E+09	1.63615E+08	-23.89990
A2	2.66634E+08	8.53290E+06	31.24770

DATE	LHS	RHS	RESIDUAL
1964	1.937243E+08	8.912461E+07	1.045997E+08
1965	3.625390E+08	3.557583E+08	6.780672E+06
1966	5.663555E+08	6.223918E+08	-5.603635E+07
1967	8.357153E+08	8.890250E+08	-5.330970E+07
1968	1.133460E+09	1.155658E+09	-2.219827E+07
1969	1.388032E+09	1.422291E+09	-3.425971E+07
1970	1.644351E+09	1.688925E+09	-4.457318E+07
1971	1.954771E+09	1.955558E+09	-786432.
1972	2.321978E+09	2.222191E+09	9.978675E+07

16: CUMSUP2 = A1+A2*TIMPD

NOB = 7 NOVAR = 2
RANGE = 1973 TO 1979
RSQ = 0.97187 CRSQ = 0.96624 F(1/5) = 172.722
SER = 7.59E+07 SSR = 2.881E+16 DW(0) = 1.26

COEF	VALUE	ST ER	T-STAT
A1	2.29562E+08	6.41523E+07	3.57839
A2	1.88526E+08	1.43449E+07	13.14240

DATE	LHS	RHS	RESIDUAL
1973	3.184361E+08	4.180877E+08	-9.965158E+07
1974	6.252721E+08	6.066135E+08	1.865856E+07
1975	9.153958E+08	7.951393E+08	1.202565E+08
1976	1.023898E+09	9.836652E+08	4.023296E+07
1977	1.142489E+09	1.172191E+09	-2.970214E+07
1978	1.323018E+09	1.360717E+09	-3.769933E+07
1979	1.537149E+09	1.549243E+09	-1.209344E+07

```
SUP1FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 15
 IN MODEL COMMODFC

    DATA
      1964        8.912461E+07  3.557583E+08  6.223918E+08  8.890250E+08
      1968        1.155658E+09  1.422291E+09  1.688925E+09  1.955558E+09
      1972        2.222191E+09

SUP2FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 16
 IN MODEL COMMODFC

    DATA
      1973        4.180877E+08  6.066135E+08  7.951393E+08  9.836652E+08
      1977        1.172191E+09  1.360717E+09  1.549243E+09
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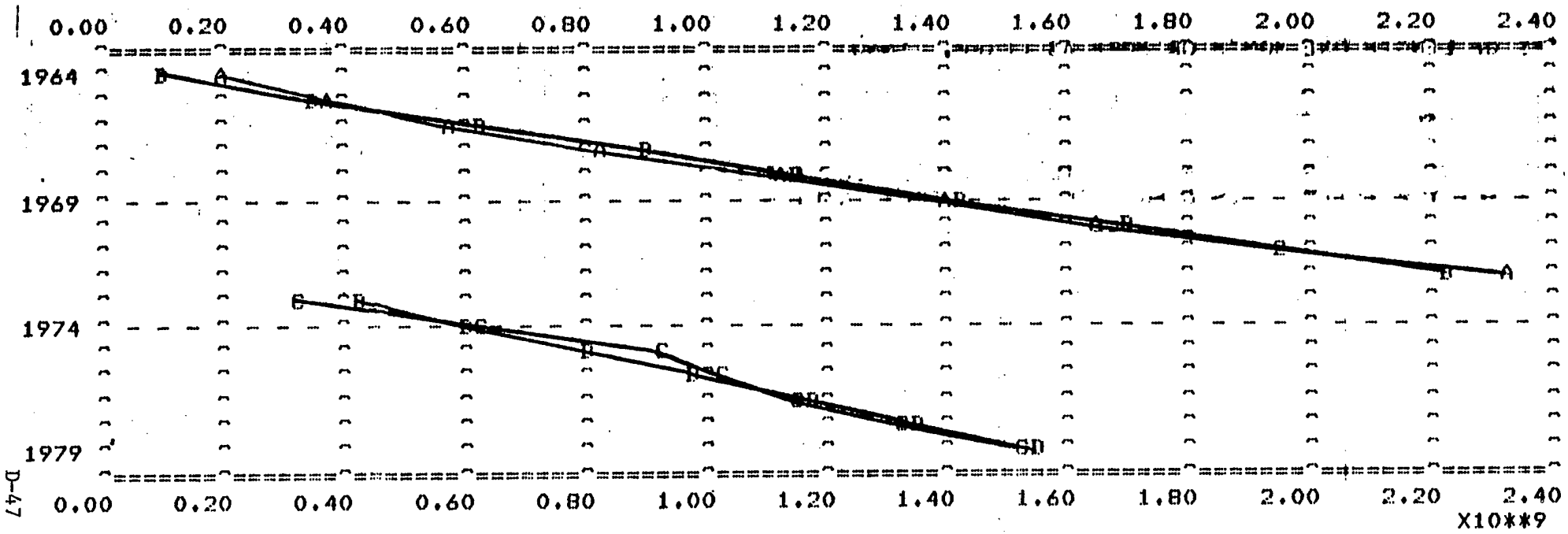


**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMSUP1
B	#1	SUP1FC
C	#1	CUMSUP2
D	#1	SUP2FC

****

35: CUMSUP11 = A1+A2*TIM

NOB = 12 NOVAR = 2
RANGE = 1964 TO 1975
RSQ = 0.99449 CRSQ = 0.99394 F(1/10) = 1804.470
SER = 8.01E+07 SSR = 6.421E+16 DW(0) = 0.49

COEF	VALUE	ST ER	T-STAT
A1	-4.23335E+09	1.39308E+08	-30.38840
A2	2.84659E+08	6.70116E+06	42.47900

DATE	LHS	RHS	RESIDUAL
1964	1.937243E+08	3.653427E+07	1.571900E+08
1965	3.625390E+08	3.211932E+08	4.134579E+07
1966	5.663555E+08	6.058488E+08	-3.949338E+07
1967	8.357153E+08	8.905085E+08	-5.479322E+07
1968	1.133460E+09	1.175168E+09	-4.170829E+07
1969	1.388032E+09	1.459828E+09	-7.179622E+07
1970	1.644351E+09	1.744488E+09	-1.001362E+08
1971	1.954771E+09	2.029143E+09	-7.437184E+07
1972	2.321978E+09	2.313803E+09	8.174848E+06
1973	2.640414E+09	2.598463E+09	4.195123E+07
1974	2.947250E+09	2.883122E+09	6.412749E+07
1975	3.237374E+09	3.167782E+09	6.959155E+07

36: CUMSUP22 = A1+A2*TIMPDX5

NOB = 4 NOVAR = 2
RANGE = 1976 TO 1979
RSQ = 0.98455 CRSQ = 0.97682 F(1/2) = 127.441
SER = 3.41E+07 SSR = 2.322E+15 DW(0) = 2.02

COEF	VALUE	ST ER	T-STAT
A1	-8.88278E+07	4.17327E+07	-2.12849
A2	1.72028E+08	1.52386E+07	11.28900

DATE	LHS	RHS	RESIDUAL
1976	1.085025E+08	8.320051E+07	2.530198E+07
1977	2.270933E+08	2.552288E+08	-2.813552E+07
1978	4.076221E+08	4.272568E+08	-1.963469E+07
1979	6.217539E+08	5.992852E+08	2.246861E+07

```
CSUP1FC - DATE REVISED:  9/23/80

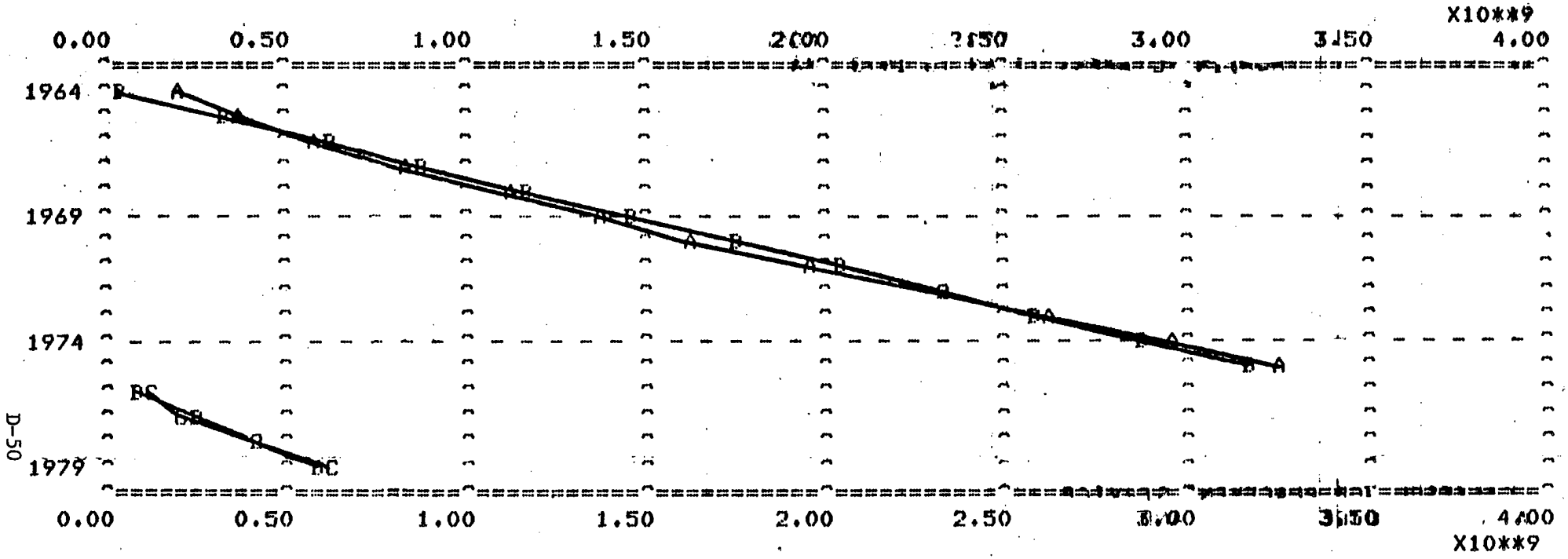
    ANNUAL DATA FROM 1964 TO 1975
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 35
 IN MODEL COMMODFC

    DATA
      1964        3.653427E+07  3.211932E+08  6.058488E+08  8.905085E+08
      1968        1.175168E+09  1.459828E+09  1.744488E+09  2.029143E+09
      1972        2.313803E+09  2.598463E+09  2.883122E+09  3.167782E+09

CSUP2FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1976 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 36
 IN MODEL COMMODFC

    DATA
      1976        8.320051E+07  2.552288E+08  4.272568E+08  5.992852E+08
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMSUP11
B	#1	CSUP1FC
C	#1	CUMSUP22
D	#1	CSUP2FC

****

17: CUMSOPS1 = A1+A2*TIM

NOB = 9 NOVAR = 2
RANGE = 1964 TO 1972
RSQ = 0.98744 CRSQ = 0.98565 F(1/7) = 550.448
SER = 8.92E+07 SSR = 5.574E+16 DW(0) = 0.68

COEF	VALUE	ST ER	T-STAT
A1	-4.02991E+09	2.20900E+08	-18.24310
A2	2.70288E+08	1.15204E+07	23.46160

DATE	LHS	RHS	RESIDUAL
1964	1.488589E+08	2.440192E+07	1.244570E+08
1965	3.052713E+08	2.946895E+08	1.058176E+07
1966	5.579561E+08	5.649764E+08	-7.020288E+06
1967	7.594560E+08	8.352632E+08	-7.580723E+07
1968	1.012805E+09	1.105550E+09	-9.274496E+07
1969	1.308142E+09	1.375837E+09	-6.769510E+07
1970	1.600687E+09	1.646124E+09	-4.543693E+07
1971	1.932921E+09	1.916415E+09	1.650586E+07
1972	2.323902E+09	2.186702E+09	1.372001E+08

18: CUMSOPS2 = A1+A2*TIMPD

NOB = 7 NOVAR = 2
RANGE = 1973 TO 1979
RSQ = 0.98848 CRSQ = 0.98618 F(1/5) = 429.209
SER = 6.81E+07 SSR = 2.319E+16 DW(0) = 0.96

COEF	VALUE	ST ER	T-STAT
A1	2.98273E+08	5.75593E+07	5.18201
A2	2.66646E+08	1.28707E+07	20.71730

DATE	LHS	RHS	RESIDUAL
1973	4.845975E+08	5.649183E+08	-8.032077E+07
1974	8.163103E+08	8.315638E+08	-1.525350E+07
1975	1.185591E+09	1.098209E+09	8.738125E+07
1976	1.444257E+09	1.364855E+09	7.940250E+07
1977	1.629806E+09	1.631500E+09	-1.693952E+06
1978	1.871997E+09	1.898146E+09	-2.614912E+07
1979	2.121426E+09	2.164791E+09	-4.336512E+07

```
SOP1FC - DATE REVISED:  9/23/80

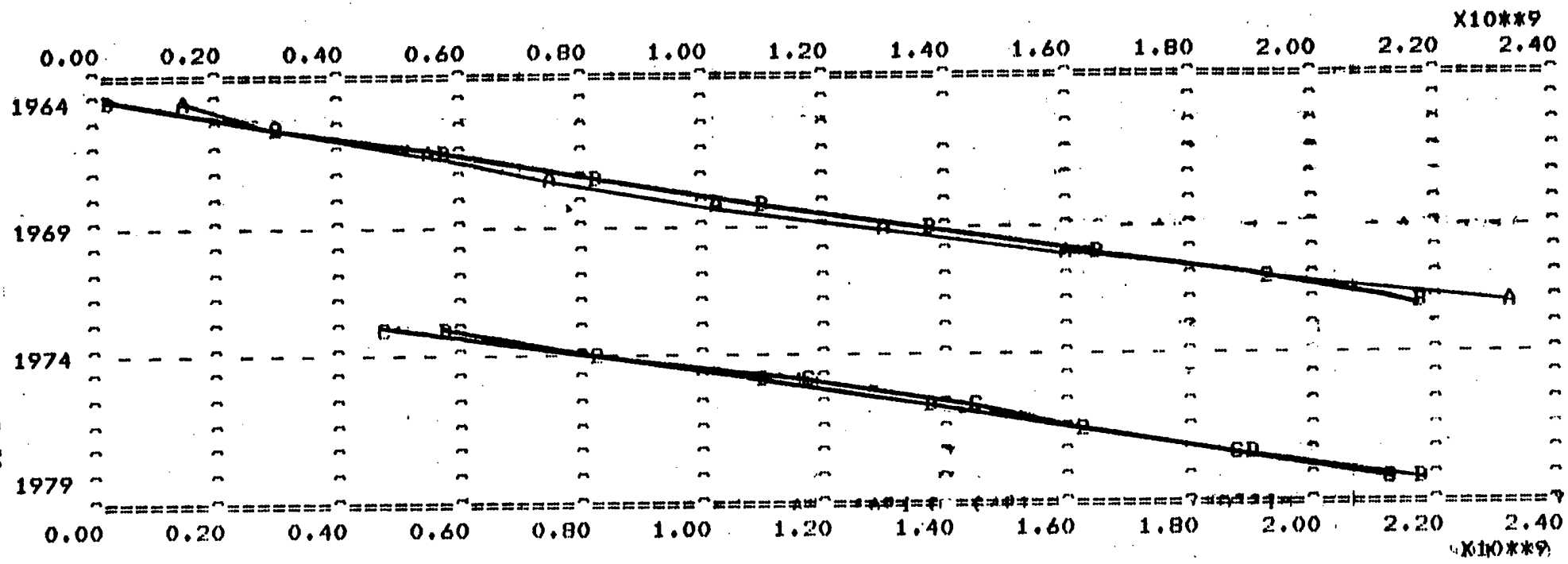
    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 17
 IN MODEL COMMODFC

    DATA
      1964        2.440192E+07  2.946895E+08  5.649764E+08  8.352632E+08
      1968        1.105550E+09  1.375837E+09  1.646124E+09  1.916415E+09
      1972        2.186702E+09

SOP2FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 18
 IN MODEL COMMODFC

    DATA
      1973        5.649183E+08  8.315638E+08  1.098209E+09  1.364855E+09
      1977        1.631500E+09  1.898146E+09  2.164791E+09
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMSOPS1
B	#1	SOP1FC
C	#1	CUMSOPS2
D	#1	SOP2FC

****

19: CUMEQMN1 = A1+A2*TIM

NOB = 9 NOVAR = 2
RANGE = 1964 TO 1972
RSQ = 0.96094 CRSQ = 0.95536 F(1/7) = 172.202
SER = 6.61E+07 SSR = 3.055E+16 DW(0) = 1.40

COEF	VALUE	ST ER	T-STAT
A1	-1.67187E+09	1.63542E+08	-10.22280
A2	1.11924E+08	8.52911E+06	13.12250

DATE	LHS	RHS	RESIDUAL
1964	4.096874E+07	6.983936E+06	3.398480E+07
1965	1.301327E+08	1.189076E+08	1.122507E+07
1966	2.122725E+08	2.308311E+08	-1.855856E+07
1967	3.730824E+08	3.427546E+08	3.032781E+07
1968	4.471224E+08	4.546783E+08	-7.555840E+06
1969	5.101279E+08	5.666017E+08	-5.647386E+07
1970	6.109791E+08	6.785254E+08	-6.754637E+07
1971	7.344248E+08	7.904489E+08	-5.602406E+07
1972	1.032988E+09	9.023726E+08	1.306156E+08

20: CUMEQMN2 = A1+A2*TIMPD

NOB = 7 NOVAR = 2
RANGE = 1973 TO 1979
RSQ = 0.98163 CRSQ = 0.97796 F(1/5) = 267.176
SER = 1.94E+08 SSR = 1.881E+17 DW(0) = 1.88

COEF	VALUE	ST ER	T-STAT
A1	-5.29206E+08	1.63943E+08	-3.22799
A2	5.99205E+08	3.66587E+07	16.34550

DATE	LHS	RHS	RESIDUAL
1973	2.336664E+08	6.999936E+07	1.636670E+08
1974	6.081953E+08	6.692047E+08	-6.100941E+07
1975	9.470907E+08	1.268410E+09	-3.213194E+08
1976	1.935353E+09	1.867615E+09	6.773709E+07
1977	2.684841E+09	2.466821E+09	2.180201E+08
1978	3.035107E+09	3.066026E+09	-3.091968E+07
1979	3.629061E+09	3.665232E+09	-3.617050E+07

```
EQM1FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 19
 IN MODEL COMMODFC

    DATA
      1964        6.983936E+06  1.189076E+08  2.308311E+08  3.427546E+08
      1968        4.546783E+08  5.666017E+08  6.785254E+08  7.904489E+08
      1972        9.023726E+08

EQM2FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 20
 IN MODEL COMMODFC

    DATA
      1973        6.999936E+07  6.692047E+08  1.268410E+09  1.867615E+09
      1977        2.466821E+09  3.066026E+09  3.665232E+09
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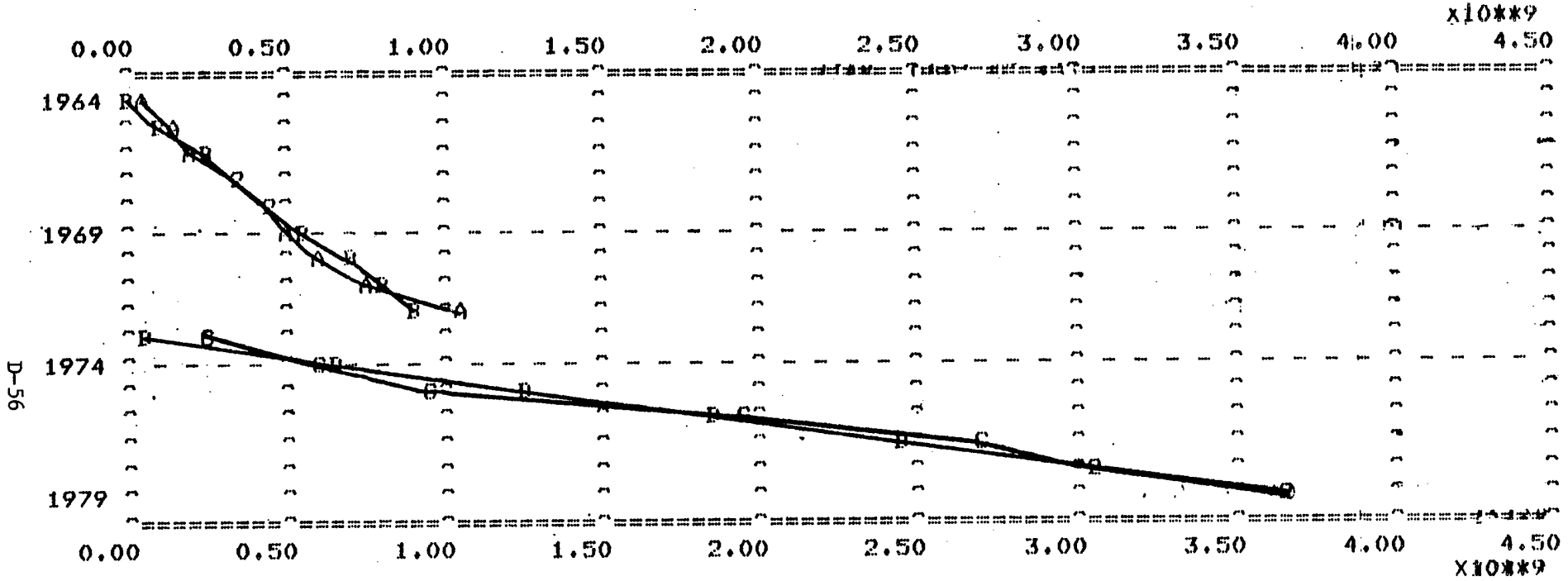


**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMEQMN1
B	#1	EQM1FC
C	#1	CUMEQMN2
D	#1	EQM2FC

37: CUMEQ11 = A1+A2*TIM

NOB = 8 NOVAR = 2
RANGE = 1964 TO 1971
RSQ = 0.99228 CRSQ = 0.99099 F(1/6) = 771.042
SER = 2.29E+07 SSR = 3.134E+15 DW(0) = 2.15

COEF	VALUE	ST ER	T-STAT
A1	-1.42930E+09	6.57431E+07	-21.74060
A2	9.79289E+07	3.52673E+06	27.76760

DATE	LHS	RHS	RESIDUAL
1964	4.096874E+07	3.963750E+07	1.331232E+06
1965	1.301327E+08	1.375665E+08	-7.433744E+06
1966	2.122725E+08	2.354952E+08	-2.322262E+07
1967	3.730824E+08	3.334241E+08	3.965824E+07
1968	4.471224E+08	4.313531E+08	1.576934E+07
1969	5.101279E+08	5.292820E+08	-1.915418E+07
1970	6.109791E+08	6.272110E+08	-1.623194E+07
1971	7.344248E+08	7.251400E+08	9.284864E+06

38: CUMEQ22 = A1+A2*TIMPDX6

NOB = 8 NOVAR = 2
RANGE = 1972 TO 1979
RSQ = 0.97356 CRSQ = 0.96915 F(1/6) = 220.910
SER = 2.42E+08 SSR = 3.515E+17 DW(0) = 1.28

COEF	VALUE	ST ER	T-STAT
A1	-5.65245E+08	1.88598E+08	-2.99708
A2	5.55105E+08	3.73480E+07	14.86300

DATE	LHS	RHS	RESIDUAL
1972	2.985633E+08	-1.014042E+07	3.087037E+08
1973	5.322296E+08	5.449646E+08	-1.273498E+07
1974	9.067587E+08	1.100070E+09	-1.933110E+08
1975	1.245654E+09	1.655175E+09	-4.095206E+08
1976	2.233916E+09	2.210280E+09	2.363622E+07
1977	2.983404E+09	2.765385E+09	2.180196E+08
1978	3.333670E+09	3.320490E+09	1.318016E+07
1979	3.927624E+09	3.875593E+09	5.203174E+07

```
CEQM1FC - DATE REVISED:  9/23/80

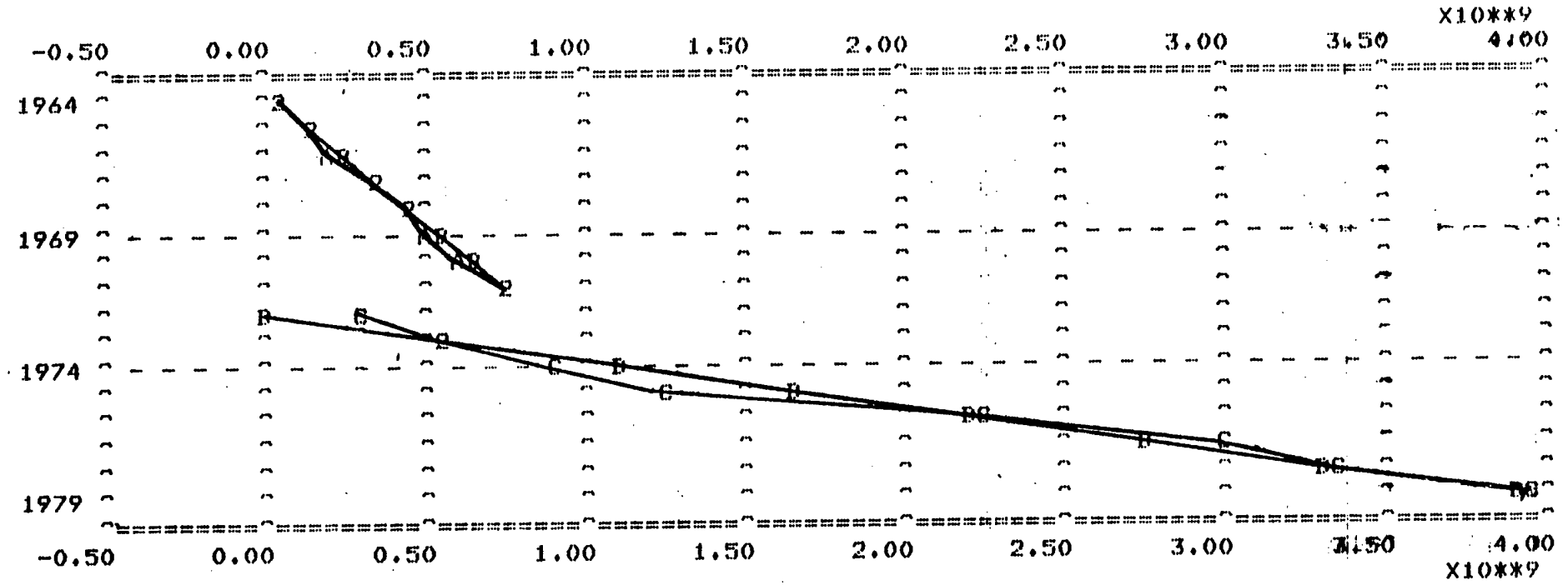
    ANNUAL DATA FROM 1964 TO 1971
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 37
 IN MODEL COMMODFC

    DATA
      1964        3.963750E+07  1.375665E+08  2.354952E+08  3.334241E+08
      1968        4.313531E+08  5.292820E+08  6.272110E+08  7.251400E+08

CEQM2FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1972 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 38
 IN MODEL COMMODFC

    DATA
      1972       -1.014042E+07  5.449646E+08  1.100070E+09  1.655175E+09
      1976        2.210280E+09  2.765385E+09  3.320490E+09  3.875593E+09
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMEQ11
B	#1	CEQM1FC
C	#1	CUMEQ22
D	#1	CEQM2FC

39: CUMCON1 = A1+A2*TIM

NOB = 8 NOVAR = 2
RANGE = 1965 TO 1972
RSQ = 0.88576 CRSQ = 0.86672 F(1/6) = 46.520
SER = 2.83E+07 SSR = 4.816E+15 DW(0) = 0.81

COEF	VALUE	ST ER	T-STAT
A1	-3.69095E+08	8.58317E+07	-4.30022
A2	2.98164E+07	4.37155E+06	6.82057

DATE	LHS	RHS	RESIDUAL
1965	6.285710E+07	1.079677E+08	-4.511064E+07
1966	1.408200E+08	1.377841E+08	3.035920E+06
1967	1.912300E+08	1.676006E+08	2.362934E+07
1968	2.269305E+08	1.974170E+08	2.951358E+07
1969	2.430790E+08	2.272335E+08	1.584546E+07
1970	2.666301E+08	2.570499E+08	9.580288E+06
1971	2.815352E+08	2.868664E+08	-5.331200E+06
1972	2.855224E+08	3.166828E+08	-3.116032E+07

40: CUMCON2 = A1+A2*TIMPD

NOB = 7 NOVAR = 2
RANGE = 1973 TO 1979
RSQ = 0.96412 CRSQ = 0.95694 F(1/5) = 134.346
SER = 2.05E+07 SSR = 2.105E+15 DW(0) = 1.19

COEF	VALUE	ST ER	T-STAT
A1	-3.61440E+07	1.73430E+07	-2.08406
A2	4.49493E+07	3.87802E+06	11.59080

DATE	LHS	RHS	RESIDUAL
1973	2.536514E+07	8.805312E+06	1.655982E+07
1974	6.340845E+07	5.375461E+07	9.653840E+06
1975	8.410942E+07	9.870390E+07	-1.459448E+07
1976	1.258103E+08	1.436532E+08	-1.784293E+07
1977	1.769397E+08	1.886025E+08	-1.166278E+07
1978	2.211567E+08	2.335518E+08	-1.239507E+07
1979	3.087831E+08	2.785009E+08	3.028224E+07

```
CON1FC - DATE REVISED:  9/23/80

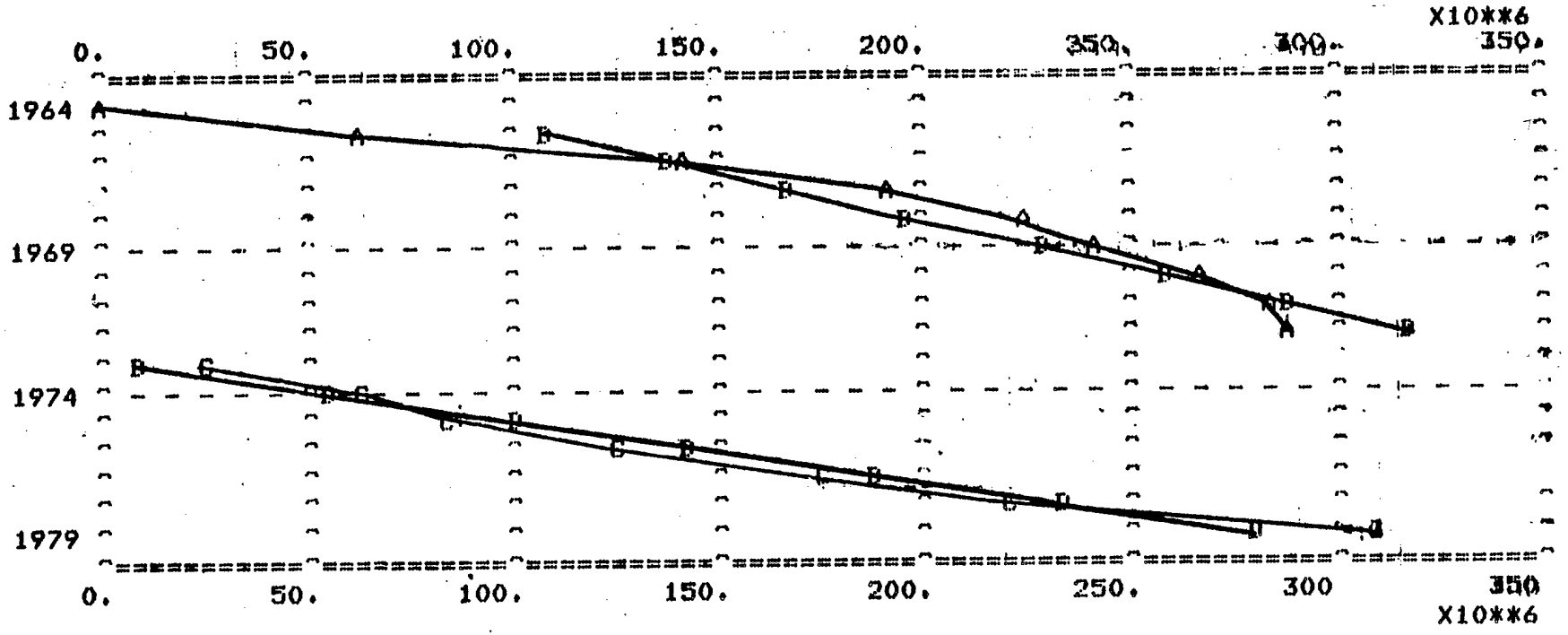
    ANNUAL DATA FROM 1965 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 39
 IN MODEL COMMODFC

    DATA
      1965        1.079677E+08  1.377841E+08  1.676006E+08  1.974170E+08
      1969        2.272335E+08  2.570499E+08  2.868664E+08  3.166828E+08

CON2FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 40
 IN MODEL COMMODFC

    DATA
      1973        8.805312E+06  5.375461E+07  9.870390E+07  1.436532E+08
      1977        1.886025E+08  2.335518E+08  2.785009E+08
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMCON1
B	#1	CON1FC
C	#1	CUMCON2
D	#1	CON2FC

****

43: CUMCON11 = A1+A2*TIM

NOB = 8 NOVAR = 2
RANGE = 1964 TO 1971
RSQ = 0.92186 CRSQ = 0.90886 F(1/6) = 70.803
SER = 3.06E+07 SSR = 5.600E+15 DW(0) = 0.64

COEF	VALUE	ST ER	T-STAT
A1	-5.57218E+08	8.78798E+07	-6.34068
A2	3.96677E+07	4.71424E+06	8.41445

DATE	LHS	RHS	RESIDUAL
1964	0.	3.779789E+07	-3.779789E+07
1965	6.285710E+07	7.746586E+07	-1.460875E+07
1966	1.408200E+08	1.171336E+08	2.368642E+07
1967	1.912300E+08	1.568013E+08	3.442870E+07
1968	2.269305E+08	1.964690E+08	3.046155E+07
1969	2.430790E+08	2.361367E+08	6.942288E+06
1970	2.666301E+08	2.758044E+08	-9.174272E+06
1971	2.815352E+08	3.154721E+08	-3.393690E+07

44: CUMCON22 = A1+A2*TIMPDX1

NOB = 8 NOVAR = 2
RANGE = 1972 TO 1979
RSQ = 0.96263 CRSQ = 0.9564 F(1/6) = 154.559
SER = 2.19E+07 SSR = 2.868E+15 DW(0) = 1.02

COEF	VALUE	ST ER	T-STAT
A1	-5.90341E+07	1.70342E+07	-3.46561
A2	4.19373E+07	3.37328E+06	12.43220

DATE	LHS	RHS	RESIDUAL
1972	3.987229E+06	-1.709678E+07	2.108400E+07
1973	2.935235E+07	2.484051E+07	4.511840E+06
1974	6.739566E+07	6.677781E+07	617856.
1975	8.809664E+07	1.087151E+08	-2.061846E+07
1976	1.297975E+08	1.506524E+08	-2.085491E+07
1977	1.809269E+08	1.925897E+08	-1.166277E+07
1978	2.251439E+08	2.345268E+08	-9.382848E+06
1979	3.127703E+08	2.764641E+08	3.630618E+07

```
CON11FC - DATE REVISED:  9/23/80

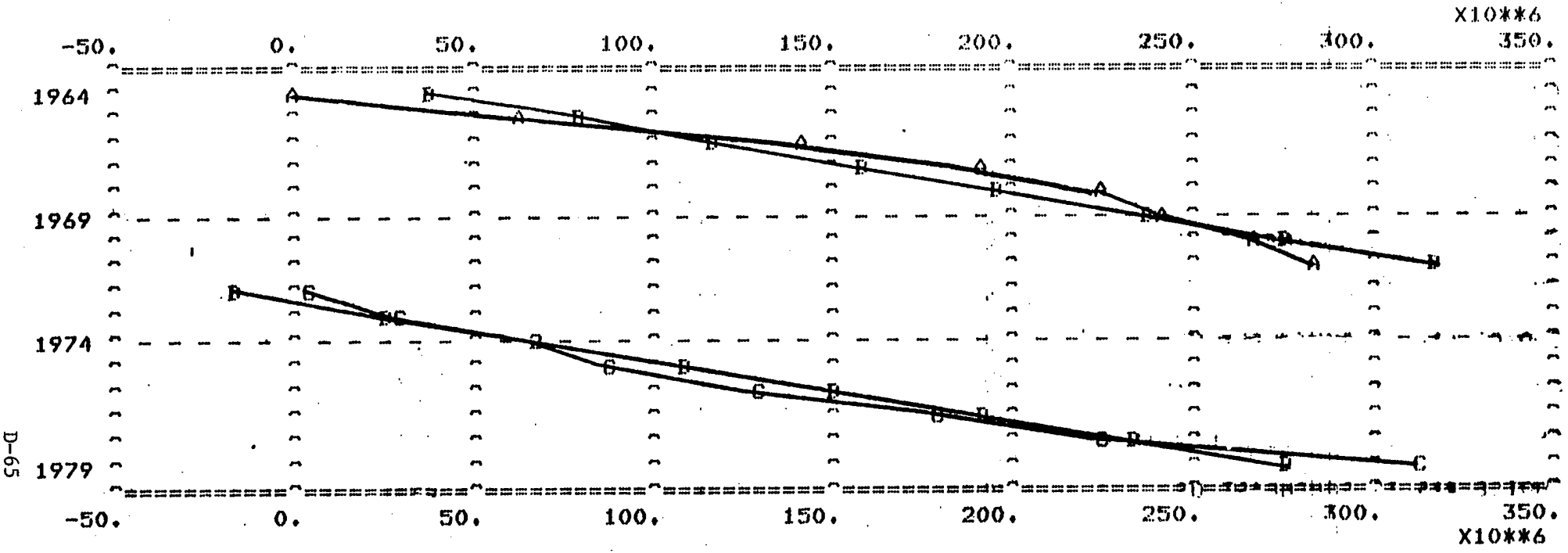
    ANNUAL DATA FROM 1964 TO 1971
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 43
 IN MODEL COMMODFC

    DATA
      1964        3.779789E+07  7.746586E+07  1.171336E+08  1.568013E+08
      1968        1.964690E+08  2.361367E+08  2.758044E+08  3.154721E+08

CON22FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1972 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 44
 IN MODEL COMMODFC

    DATA
      1972       -1.709678E+07  2.484051E+07  6.677781E+07  1.087151E+08
      1976        1.506524E+08  1.925897E+08  2.345268E+08  2.764641E+08
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMCON11
B	#1	CON11FC
C	#1	CUMCON22
D	#1	CON22FC

****

21: CUMSPEC1 = A1+A2*TIM

NOB = 9 NOVAR = 2
RANGE = 1964 TO 1972
RSQ = 0.96106 CRSQ = 0.95549 F(1/7) = 172.750
SER = 7.36E+07 SSR = 3.793E+16 DW(0) = 0.65

COEF	VALUE	ST ER	T-STAT
A1	-1.99197E+09	1.82226E+08	-10.93130
A2	1.24908E+08	9.50349E+06	13.14340

DATE	LHS	RHS	RESIDUAL
1964	7.076529E+06	-1.183442E+08	1.254207E+08
1965	2.220326E+07	6.564352E+06	1.563891E+07
1966	6.239046E+07	1.314726E+08	-6.908218E+07
1967	1.881417E+08	2.563812E+08	-6.823952E+07
1968	3.202757E+08	3.812897E+08	-6.101402E+07
1969	4.650396E+08	5.061980E+08	-4.115840E+07
1970	6.208046E+08	6.311066E+08	-1.030195E+07
1971	7.869834E+08	7.560151E+08	3.096832E+07
1972	9.586865E+08	8.809234E+08	7.776307E+07

22: CUMSPEC2 = A1+A2*TIMPD

NOB = 7 NOVAR = 2
RANGE = 1973 TO 1979
RSQ = 0.95751 CRSQ = 0.94901 F(1/5) = 112.622
SER = 1.58E+08 SSR = 1.250E+17 DW(0) = 1.46

COEF	VALUE	ST ER	T-STAT
A1	-7.31885E+07	1.33630E+08	-0.54770
A2	3.17172E+08	2.98805E+07	10.61470

DATE	LHS	RHS	RESIDUAL
1973	2.235591E+08	2.439835E+08	-2.042432E+07
1974	6.484401E+08	5.611553E+08	8.728474E+07
1975	1.001374E+09	8.783273E+08	1.230467E+08
1976	1.081666E+09	1.195499E+09	-1.138335E+08
1977	1.336808E+09	1.512671E+09	-1.758630E+08
1978	1.717020E+09	1.829843E+09	-1.128230E+08
1979	2.359635E+09	2.147015E+09	2.126198E+08

```
 SPEC1FC - DATE REVISED:  9/23/80

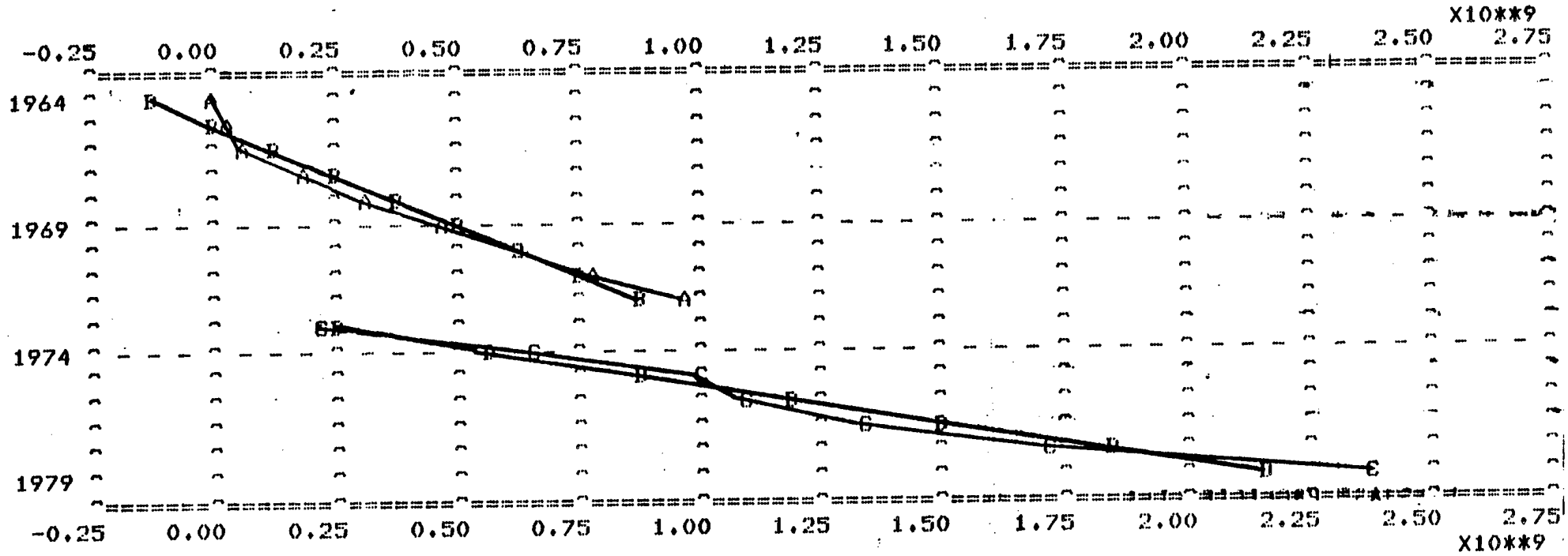
    ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 21
 IN MODEL COMMODFC

    DATA
      1964       -1.183442E+08  6.564352E+06  1.314726E+08  2.563812E+08
      1968        3.812897E+08  5.061980E+08  6.311066E+08  7.560151E+08
      1972        8.809234E+08

SPEC2FC - DATE REVISED:  9/23/80

    ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 22
 IN MODEL COMMODFC

    DATA
      1973        2.439835E+08  5.611553E+08  8.783273E+08  1.195499E+09
      1977        1.512671E+09  1.829843E+09  2.147015E+09
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMSPEC1
B	#1	SPEC1FC
C	#1	CUMSPEC2
D	#1	SPEC2FC

****

25: CUMTR1 = A1+A2*TIM

NOB = 9 NOVAR = 2
RANGE = 1964 TO 1972
RSQ = 0.98893 CRSQ = 0.98735 F(1/7) = 625.352
SER = 3.54E+07 SSR = 8.784E+15 DW(0) = 1.21

COEF	VALUE	ST ER	T-STAT
A1	-1.65759E+09	8.76903E+07	-18.90280
A2	1.14363E+08	4.57324E+06	25.00700

DATE	LHS	RHS	RESIDUAL
1964	9.807312E+07	5.785549E+07	4.021763E+07
1965	1.762872E+08	1.722189E+08	4.068288E+06
1966	2.750318E+08	2.865820E+08	-1.155021E+07
1967	3.954916E+08	4.009454E+08	-5.453824E+06
1968	4.997524E+08	5.153088E+08	-1.555635E+07
1969	5.633917E+08	6.296722E+08	-6.628045E+07
1970	7.450854E+08	7.440356E+08	1.049856E+06
1971	8.637087E+08	8.583987E+08	5.309952E+06
1972	1.020955E+09	9.727621E+08	4.819302E+07

26: CUMTR2 = A1+A2*TIMPD

NOB = 7 NOVAR = 2
RANGE = 1973 TO 1979
RSQ = 0.91751 CRSQ = 0.90101 F(1/5) = 55.611
SER = 3.06E+08 SSR = 4.695E+17 DW(0) = 1.24

COEF	VALUE	ST ER	T-STAT
A1	-6.59502E+08	2.58987E+08	-2.54647
A2	4.31862E+08	5.79112E+07	7.45730

DATE	LHS	RHS	RESIDUAL
1973	8.764086E+07	-2.276403E+08	3.152812E+08
1974	2.355352E+08	2.042212E+08	3.131405E+07
1975	4.118999E+08	6.360827E+08	-2.241828E+08
1976	8.676416E+08	1.067944E+09	-2.003026E+08
1977	1.326429E+09	1.499806E+09	-1.733765E+08
1978	1.727811E+09	1.931667E+09	-2.038564E+08
1979	2.818657E+09	2.363529E+09	4.551281E+08

TR1FC - DATE REVISED: 9/23/80

ANNUAL DATA FROM 1964 TO 1972
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 25
IN MODEL COMMODFC

DATA

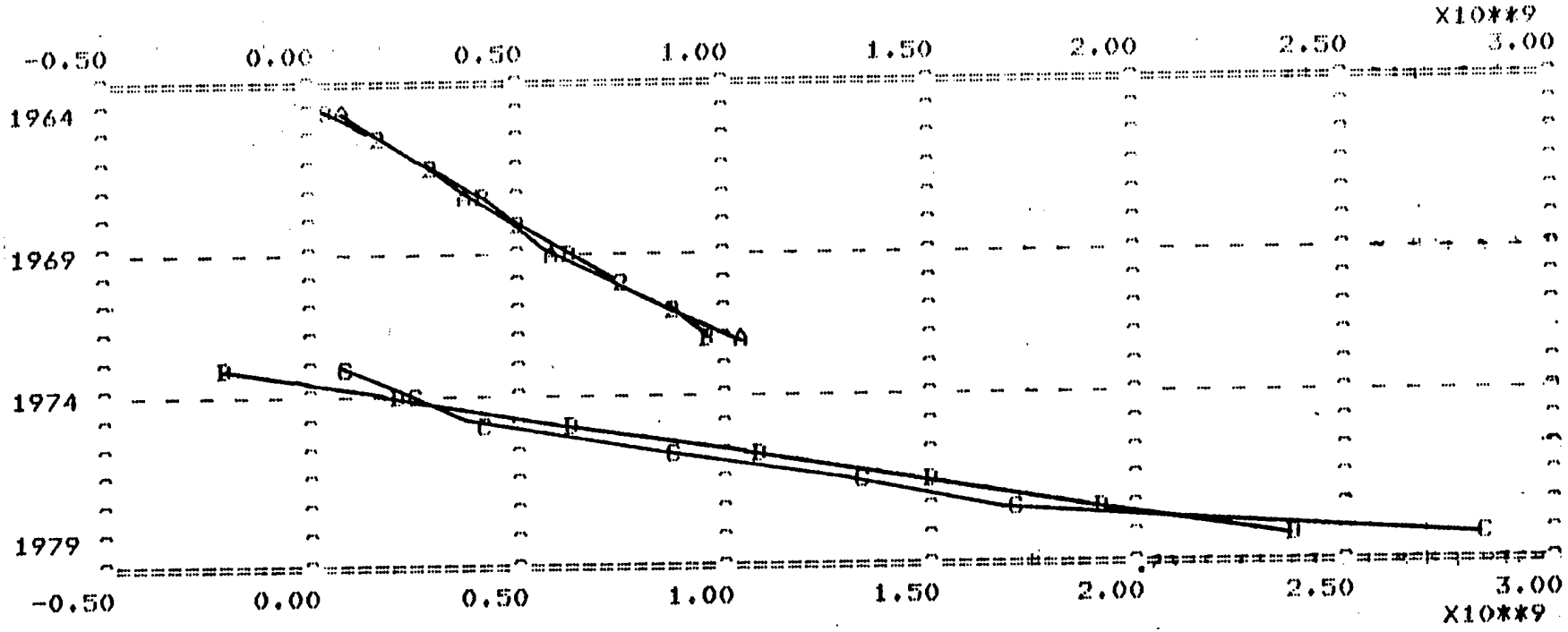
1964	5.785549E+07	1.722189E+08	2.865820E+08	4.009454E+08
1968	5.153088E+08	6.296722E+08	7.440356E+08	8.583987E+08
1972	9.727621E+08			

TR2FC - DATE REVISED: 9/23/80

ANNUAL DATA FROM 1973 TO 1979
COMMENT:
RHS DATA CREATED BY REGRESSION OF EQUATION 26
IN MODEL COMMODFC

DATA

1973	-2.276403E+08	2.042212E+08	6.360827E+08	1.067944E+09
1977	1.499806E+09	1.931667E+09	2.363529E+09	



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	CUMTR1
B	#1	TR1FC
C	#1	CUMTR2
D	#1	TR2FC

****

APPENDIX E

REGRESSION ANALYSIS OF SALES AND DELIVERIES

For each regression analysis, the following statistics are generated:

NOB is the number of observations (30 for the entire period 1950-1979).

NOVAR is the number of coefficients to be determined $\sum_{i=1}^{n} (a_i)$ = NOVAR.

Range is the years of data used.

RSQ is the square of the coefficient of correlation (i.e., the coefficient determination)

CSRQ is the adjusted value of the coefficient of determination.

SER is the standard error of the regression [i.e., $\sqrt{SSR/(NOB - NOVAR)}$].

SSR is the sum of the squares of the differences (or residuals) between the actual values observed (LHS) and the values forecast by the test equation (RHS).

F(a/b) is the F test which measures how well the test equation fits the data.

DW(Ø) is the Durbin-Watson statistic which tests whether an autocorrelation of one-time lag is present in the residuals. If the DW range is between 1.5 and 2.5, no autocorrelation exists.

ST ER is the standard error in the values of the equation coefficient as developed by the regression.

T-STAT is the number of times the standard error in the values of the equation coefficients as determined by the regression can be divided into that value.

LHS is the left hand side or actual data observed.

RHS is the right hand side or computed data developed.

RESIDUAL is the difference between the actual data (LHS) and the computed data (RHS).

The regression analysis of sales and deliveries develops a relationship between total dollar sales and total dollar deliveries over the period 1950-1979. Two cycles were determined: 1950-1971 and 1972-1979.

- Page E-4 shows the regression of deliveries on sales for the period 1950-1971.
- Page E-5 shows the regression of deliveries on sales for the period 1972-1979.
- Page E-6 combines the regression data for both periods into a single data set.
- Page E-7 is the plot of forecast deliveries against actual deliveries.

Further analysis is required to determine whether cumulative deliveries can yield better projections.

%3: DELI = A1+A2*ALL1+A2*ALL2+A3*ALL3+A4*ALL4+A5*ALL5

NOB = 22 NOVAR = 5
RANGE = 1950 TO 1971
RSQ = 0.78525 CRSQ = 0.73472 F(4/17) = 15.540
SER = 5.22E+05 SSR = 4.624E+12 DW(0) = 1.34

COEF	VALUE	ST ER	T-STAT
A1	-3.75673E+05	4.45942E+05	-0.84243
A2	0.16173	0.07526	2.14889
A3	0.63101	0.16042	3.93347
A4	-0.12585	0.18774	-0.67033
A5	0.28153	0.13045	2.15806

DATE	LHS	RHS	RESIDUAL
1950	71234.	-113716.	184950.
1951	1.166194E+06	708530.	457664.
1952	1.788480E+06	2.334515E+06	-546035.
1953	4.584429E+06	3.991523E+06	592906.
1954	3.890734E+06	3.762996E+06	127738.
1955	2.934008E+06	3.082267E+06	-148259.
1956	3.702885E+06	3.261324E+06	441561.
1957	3.197661E+06	2.234276E+06	963385.
1958	2.990586E+06	2.639774E+06	350812.
1959	2.589560E+06	2.098351E+06	491209.
1960	2.284082E+06	1.999768E+06	284314.
1961	1.719637E+06	2.455437E+06	-735800.
1962	1.549741E+06	2.036050E+06	-486309.
1963	2.518547E+06	2.266003E+06	252544.
1964	1.787748E+06	2.163750E+06	-376002.
1965	2.185042E+06	2.416970E+06	-231928.
1966	1.813854E+06	2.353708E+06	-539854.
1967	1.731479E+06	2.473919E+06	-742440.
1968	1.638824E+06	2.083944E+06	-445120.
1969	1.714173E+06	1.823028E+06	-108855.
1970	1.582988E+06	1.554134E+06	28854.
1971	1.542114E+06	1.357414E+06	184700.

3: DELI = A1+A2*ALL1+A2*ALL2+A3*ALL3+A4*ALL4+A5*ALL5

NOB = 8 NOVAR = 5
RANGE = 1972 TO 1979
RSQ = 0.95776 CRSQ = 0.90145 F(4/3) = 17.007
SER = 3.18E+05 SSR = 3.025E+11 DW(0) = 3.56

COEF	VALUE	ST ER	T-STAT
A1	9.54180E+05	3.48224E+05	2.74013
A2	0.05764	0.04017	1.43503
A3	0.12059	0.19285	0.62527
A4	0.13777	0.32621	0.42233
A5	-5.46364E-04	0.23728	-0.00230

DATE	LHS	RHS	RESIDUAL
1972	1.583763E+06	1.567686E+06	16077.
1973	1.522798E+06	1.753779E+06	-230981.
1974	2.627001E+06	2.216924E+06	410077.
1975	2.622275E+06	2.885989E+06	-263714.
1976	3.651090E+06	3.559486E+06	91604.
1977	3.957454E+06	4.005890E+06	-48436.
1978	4.073864E+06	4.053729E+06	20135.
1979	3.477155E+06	3.471897E+06	5258.

DELRHS - DATE REVISED: 7/22/80

ANNUAL DATA FROM 1950 TO 1979
COMMENT:
DELRHS = COMBINE(DRHSC1,DRHSC2)

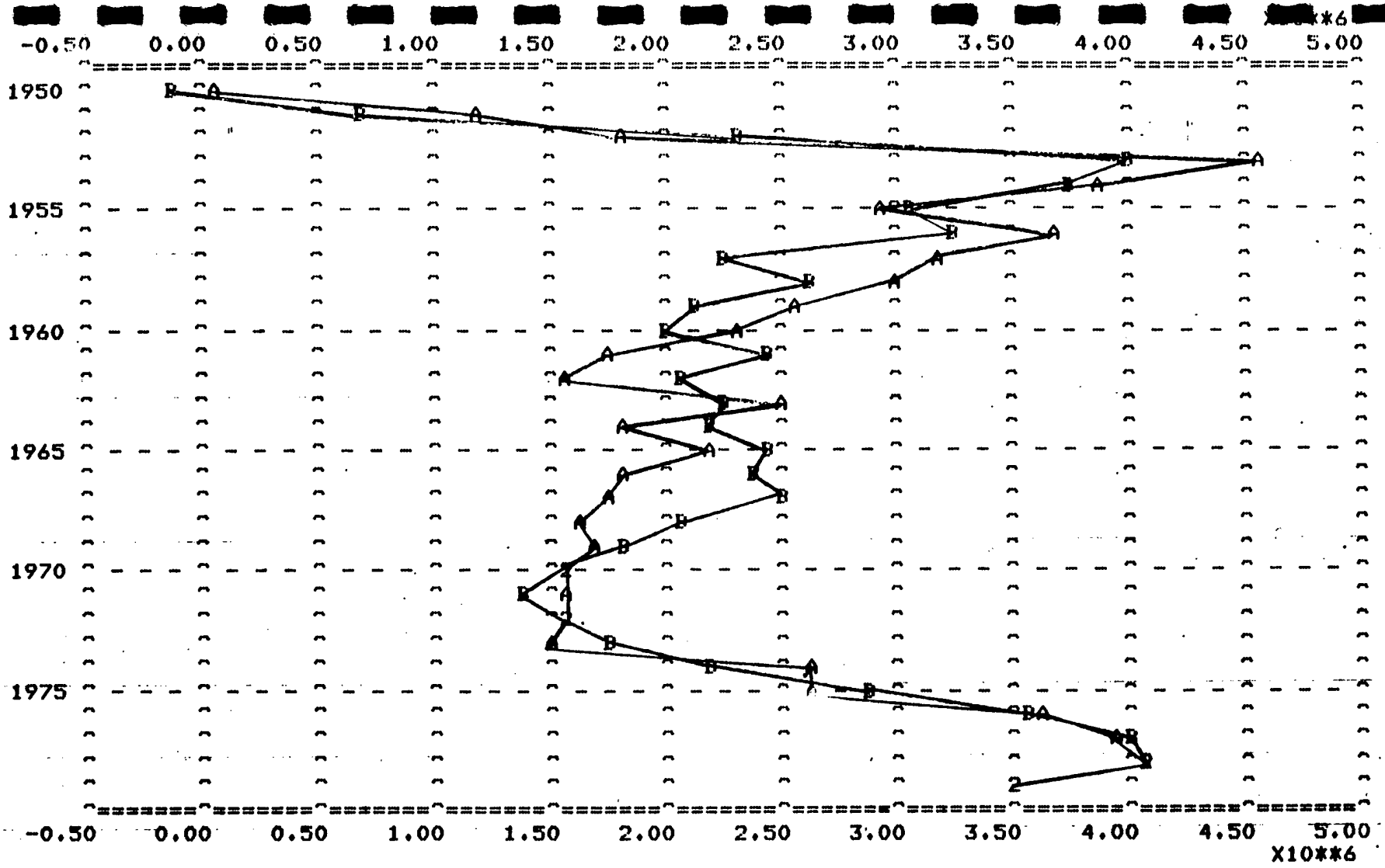
DATA

1950	-113716.	708530.	2.334515E+06	3.991523E+06
1954	3.762996E+06	3.082267E+06	3.261324E+06	2.234276E+06
1958	2.639774E+06	2.098351E+06	1.999768E+06	2.455437E+06
1962	2.036050E+06	2.266003E+06	2.163750E+06	2.416970E+06
1966	2.353708E+06	2.473919E+06	2.083944E+06	1.823028E+06
1970	1.554134E+06	1.357414E+06	1.567686E+06	1.753779E+06
1974	2.216924E+06	2.885989E+06	3.559486E+06	4.005890E+06
1978	4.053729E+06	3.471897E+06		

ANNUAL DATA FROM 1950 TO 1979
COMMENT:
DELLHS = COMBINE(DLHSC1,DLHSC2)

DATA

1950	71234.	1.166194E+06	1.788480E+06	4.584429E+06
1954	3.890734E+06	2.934008E+06	3.702885E+06	3.197661E+06
1958	2.990586E+06	2.589560E+06	2.284082E+06	1.719637E+06
1962	1.549741E+06	2.518547E+06	1.787748E+06	2.185042E+06
1966	1.813854E+06	1.731479E+06	1.638824E+06	1.714173E+06
1970	1.582988E+06	1.542114E+06	1.583763E+06	1.522798E+06
1974	2.627001E+06	2.622275E+06	3.651090E+06	3.957454E+06
1978	4.073864E+06	3.477155E+06		



**********LEGEND**********

TIME BOUNDS: 1950 TO 1979

SYMBOL	SCALE	NAME
A	#1	ACTUAL DATA
B	#1	FORECAST DATA

APPENDIX F

REGRESSION ANALYSIS FOR MACRO MANPOWER FORECAST

For each regression analysis, the following statistics are generated:

NOB is the number of observations (30 for the entire period 1950-1979).

NOVAR is the number of coefficients to be determined $\sum_{i=1}^{n} (a_i) = \text{NOVAR}$.

Range is the years of data used.

RSQ is the square of the coefficient of correlation (i.e., the coefficient determination)

CSRQ is the adjusted value of the coefficient of determination.

SER is the standard error of the regression [i.e., $\sqrt{\text{SSR}/(\text{NOB} - \text{NOVAR})}$].

SSR is the sum of the squares of the differences (or residuals) between the actual values observed (LHS) and the values forecast by the test equation (RHS).

F(a/b) is the F test which measures how well the test equation fits the data.

DW(Ø) is the Durbin-Watson statistic which tests whether an autocorrelation of one-time lag is present in the residuals. If the DW range is between 1.5 and 2.5, no autocorrelation exists.

ST ER is the standard error in the values of the equation coefficient as developed by the regression.

T-STAT is the number of times the standard error in the values of the equation coefficients as determined by the regression can be divided into that value.

LHS is the left hand side or actual data observed.

RHS is the right hand side or computed data developed.

RESIDUAL is the difference between the actual data (LHS) and the computed data (RHS).

This appendix shows one regression set performed to test and validate a *macro* manpower forecast model.

$$\text{Manpower} = b_1 + b_2(\text{Sales}) + b_3(\text{Deliveries})$$

Sets of manpower data were derived from Security Assistance Manpower Reports covering the years 1977-1982 (Figure 3.3). The data contained 3 years (1977-1979) of actual total manpower (in man-years) and 3 years (1980-1982) of estimated total manpower (in man-years). The model was tested using various combinations of data.

- Page F-4 illustrates one regression (MYRS80) which uses man-year data from April 1978 in combination with man-year data from January 1980.
- Page F-5 shows Sales data (ALL1), and Deliveries data (DEL1) which are used in the forecast. The constant b_2 from the regression of MYRS80 is multiplied by ALL1 and equals MPWRSL. On page F-6, the constant b_3 is multipled by DEL1 and equals MPWRDL. Finally, MPWRSL and MPWRDL are added to the constant b_1 to provide the man-year forecast (MPWRFCST).
- Page F-7 plots the forecast manpower data for the period 1970-1979 against the reported manpower data for 1977-1979.

The differences between reported and forecast manpower are very small and the coefficient of determination is abnormally high. Nonetheless, there are insufficient data to draw conclusions about this methodology except that the form of the equation is likely to be satisfactory. Only three actual data points were available to use in a regression which was used to determine three constants. Large differences in the regression constants result when the manpower data used in the regression are varied slightly. Much more data must be available before a *macro* manpower forecasting method can be adequately tested and validated.

MYRS80 - DATE REVISED: 7/18/80

ANNUAL DATA FROM 1977 TO 1982

DATA

1977	21758.	24566.	23049.	23507.
1981	22741.	22283.		

1: MYRS80 = B1+B2*ALL1+B3*DELI

NOB = 3 NOVAR = 3
RANGE = 1977 TO 1979
RSQ = 1. CRSQ = 1. F(2/0) = 1.08E+10
SER = 0.0135 SSR = 1.831E-04 DW(0) = 0.00

COEF	VALUE	ST ER	T-STAT
B1	1190.01000	0.17152	6938.13000
B2	0.00221	1.54561E-08	1.42974E+05
B3	0.00242	3.17887E-08	76013.30000

MNYR782 - DATE REVISED: 7/18/80

ANNUAL DATA FROM 1977 TO 1982

DATA

1977	21758.	24566.	25432.	25787.
1981	22741.	22283.		

1: MNYRS782 = B1+B2*ALL1+B3*DELI

NOB = 3 NOVAR = 3
RANGE = 1977 TO 1979
RSQ = 1. CRSQ = 1. F(2/0) = 4.65E+10
SER = 6.77E-03 SSR = 4.578E-05 DW(0) = 0.00

COEF	VALUE	ST ER	T-STAT
B1	13107.30000	0.08576	1.52839E+05
B2	0.00179	7.72805E-09	2.31488E+05
B3	-0.00187	1.58943E-08	-1.17544E+05

MANYRS78 - DATE REVISED: 7/21/80
ANNUAL DATA FROM 1977 TO 1982
DATA

1977	21843.	24566.	25406.	25694.
1981	22741.	22283.		

1: MANYRS78 = B1+B2*ALL1+B3*DELI

NOB = 3 NOVAR = 3
RANGE = 1977 TO 1979
RSQ = 1. CRSQ = 1. F(2/0) = 2.53E+10
SER = 0.0117 SSR = 1.373E-04 DW(0) = 0.11

COEF	VALUE	ST ER	T-STAT
B1	15339.20000	0.14854	1.03267E+05
B2	0.00254	1.33854E-08	1.89725E+05
B3	-0.00155	2.75298E-08	-56390.60000

ALL1 - DATE REVISED: 6/27/80

ANNUAL DATA FROM 1950 TO 1979

COMMENT:
ALL1 = ALLSALES*1000

DATA

1950	1.619699E+06	5.084000E+06	5.353898E+06	3.073500E+06
1954	2.764199E+06	1.941399E+06	2.833800E+06	2.530100E+06
1958	1.757399E+06	2.494000E+06	2.372899E+06	2.364899E+06
1962	2.170500E+06	2.441500E+06	2.501300E+06	2.812500E+06
1966	2.426100E+06	1.916399E+06	1.660500E+06	1.449399E+06
1970	1.272300E+06	1.744800E+06	2.788699E+06	4.406101E+06
1974	7.508898E+06	1.013940E+07	8.846300E+06	4.980199E+06
1978	6.123601E+06	6.089601E+06		

DELI - DATE REVISED: 7/18/80

ANNUAL DATA FROM 1950 TO 1979

DATA

1950	71234.	1.166194E+06	1.788480E+06	4.584429E+06
1954	3.890734E+06	2.934008E+06	3.702885E+06	3.197661E+06
1958	2.990586E+06	2.589560E+06	2.284082E+06	1.719637E+06
1962	1.549741E+06	2.518547E+06	1.787748E+06	2.185042E+06
1966	1.813854E+06	1.731479E+06	1.638824E+06	1.714173E+06
1970	1.582988E+06	1.542114E+06	1.583763E+06	1.522798E+06
1974	2.627001E+06	2.622275E+06	3.651090E+06	3.957454E+06
1978	4.073864E+06	3.477155E+06		

MPWRSL - DATE REVISED: 7/21/80

ANNUAL DATA FROM 1950 TO 1979

COMMENT:
MPWRSL = 0.00221*ALL1

DATA

1950	3579.53	11235.6	11832.1	6792.43
1954	6108.88	4290.49	6262.7	5591.52
1958	3883.85	5511.74	5244.11	5226.43
1962	4796.8	5395.71	5527.87	6215.62
1966	5361.68	4235.24	3669.71	3203.17
1970	2811.78	3856.01	6163.02	9737.48
1974	16594.7	22408.1	19550.3	11006.2
1978	13533.2	13458.		

MPWRDL - DATE REVISED: 7/21/80

ANNUAL DATA FROM 1950 TO 1979
COMMENT:
MPWRDL = 0.00242*DELI

DATA

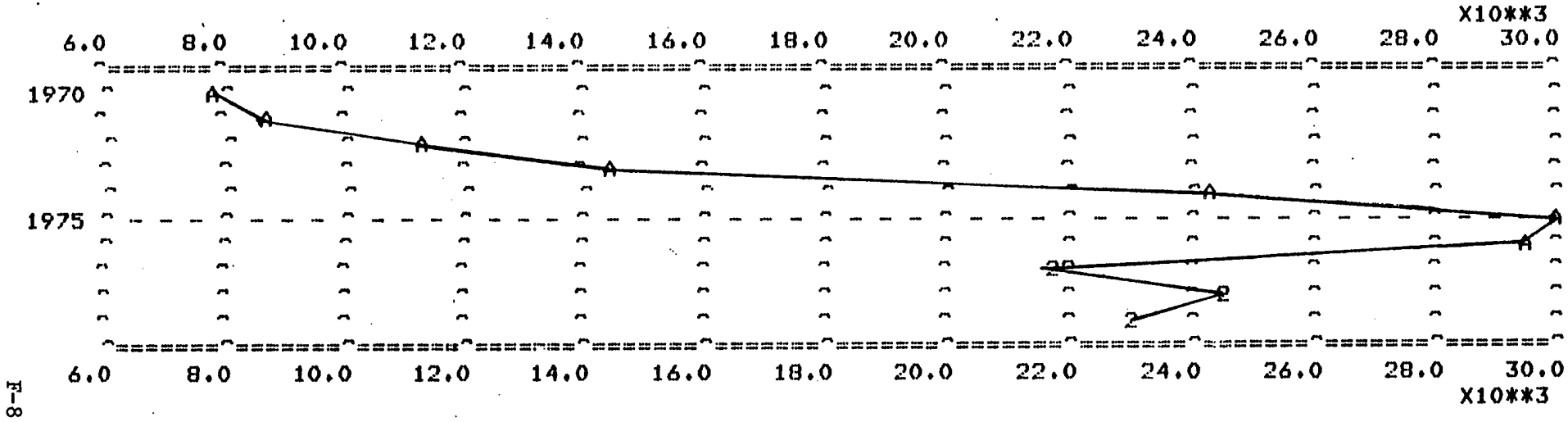
1950	172.386	2822.19	4328.12	11094.3
1954	9415.57	7100.3	8960.98	7738.34
1958	7237.21	6266.73	5527.48	4161.52
1962	3750.37	6094.88	4326.35	5287.8
1966	4389.52	4190.18	3965.95	4148.3
1970	3830.83	3731.92	3832.71	3685.17
1974	6357.34	6345.9	8835.64	9577.04
1978	9858.75	8414.71		

MPWRFCST - DATE REVISED: 7/21/80

ANNUAL DATA FROM 1950 TO 1979
COMMENT:
MPWRFCST = 1190.01+MPWRSL+MPWRDL

DATA

1950	4941.93	15247.8	17350.2	19076.8
1954	16714.5	12580.8	16413.7	14519.9
1958	12311.1	12968.5	11961.6	10578.
1962	9737.18	12680.6	11044.2	12693.4
1966	10941.2	9615.42	8825.67	8541.48
1970	7832.62	8777.93	11185.7	14612.7
1974	24142.	29944.	29576.	21773.3
1978	24581.9	23062.7		



F-8

**********LEGEND**********

TIME BOUNDS: 1970 TO 1979

ANNUAL DATA FROM 1977 TO 1979

COMMENT:
RESFCST = MPWRFCST-MYRS80

SYMBOL	SCALE	NAME
A	#1	MPWRFCST
B	#1	MYRS80

DATA

1977	15.2812	15.9141	13.7383

****

APPENDIX G

TOTAL SECURITY ASSISTANCE SALES
FORECAST FOR 1981-1985

For each regression analysis, the following statistics are generated:

NOB is the number of observations (30 for the entire period 1950-1979).

NOVAR is the number of coefficients to be determined $\sum_{i=1}^{n} (a_i)$ = NOVAR.

Range is the years of data used.

RSQ is the square of the coefficient of correlation (i.e., the coefficient determination)

CSRQ is the adjusted value of the coefficient of determination.

SER is the standard error of the regression [i.e., $\sqrt{SSR/(NOB - NOVAR)}$].

SSR is the sum of the squares of the differences (or residuals) between the actual values observed (LHS) and the values forecast by the test equation (RHS).

F(a/b) is the F test which measures how well the test equation fits the data.

DW(Ø) is the Durbin-Watson statistic which tests whether an autocorrelation of one-time lag is present in the residuals. If the DW range is between 1.5 and 2.5, no autocorrelation exists.

ST ER is the standard error in the values of the equation coefficient as developed by the regression.

T-STAT is the number of times the standard error in the values of the equation coefficients as determined by the regression can be divided into that value.

LHS is the left hand side or actual data observed.

RHS is the right hand side or computed data developed.

RESIDUAL is the difference between the actual data (LHS) and the computed data (RHS).

This Appendix contains backup data to Figure 3.10, Total Security Assistance Sales Forecast. All data shown are in constant 1967 dollars. The forecast is based on data found in Appendix B and includes data on the Indochina countries and Iran.

- Page G-4 is the forecast matrix.
- Pages G-5 and G-6 show the data base used (WORLDSPX) and the Sales forecast for each of five country groups and International Organizations (ORGFOR) for 1980-1985.
- Pages G-7 to G-13 show plots of each country group actual sales 1950-1979 (A) and the related forecast sales 1980-1985 (B).

FORECAST

	1981	1982	1983	1984	1985
WESTERN EUROPE AND NATO	1.052549E+09	8.78540E+08	7.998188E+08	1.098139E+09	1.235600E+09
NEAR EAST	1.646955E+09	3.307679E+09	2.832453E+09	3.102129E+09	2.561314E+09
SOUTH ASIA					
EAST ASIA AND PACIFIC	5.358510E+08	6.020751E+08	8.411218E+08	4.822835E+08	4.655636E+08
AFRICA	1.559342E+08	1.198395E+08	8.381742E+07	1.285629E+08	1.494416E+08
LATIN AMERICA	9.410534E+07	9.058762E+07	4.307835E+07	3.437046E+07	3.044200E+07
ORGANIZATIONS	2.391873E+08	2.876027E+08	4.287148E+08	1.666071E+08	1.576563E+08
TOTAL PROGRAM	3.724581E+09	5.785638E+09	5.029003E+09	5.012091E+09	4.600017E+09

```
WORLDSPX - DATE REVISED: 10/13/80

    ANNUAL DATA FROM 1950 TO 1979
COMMENT:
WORLDSPX = WORLDSAP*CPIX

    DATA
      1950        1.619721E+09  5.084037E+09  5.353906E+09  3.073530E+09
      1954        2.764242E+09  1.941408E+09  2.833827E+09  2.530083E+09
      1958        1.757442E+09  2.494026E+09  2.372934E+09  2.364953E+09
      1962        2.170517E+09  2.441508E+09  2.501334E+09  2.812471E+09
      1966        2.426079E+09  1.916362E+09  1.660477E+09  1.457355E+09
      1970        1.272300E+09  1.744754E+09  2.788744E+09  4.406133E+09
      1974        7.508926E+09  1.013940E+10  8.846311E+09  4.980175E+09
      1978        6.123635E+09  6.089605E+09


WORLDFOR - DATE REVISED: 10/16/80

    ANNUAL DATA FROM 1980 TO 1985
COMMENT:
WORLDFOR = WORLDSPX*2.11932

    DATA
      1980        4.168800E+09  3.724581E+09  5.285638E+09  5.029003E+09
      1984        5.012091E+09  4.600017E+09


EURFOR - DATE REVISED: 10/16/80

    ANNUAL DATA FROM 1980 TO 1985
    DATA
      1980        9.158080E+08  1.052549E+09  8.778540E+08  7.998188E+08
      1984        1.098139E+09  1.235600E+09


NEAFOR - DATE REVISED: 10/16/80

    ANNUAL DATA FROM 1980 TO 1985
COMMENT:
THIS FORECAST WAS OBTAINED BY SUBTRACTING THE SUM OF THE
OTHER FORECASTS FROM WORLDFOR.  NO ADJUSTMENTS WERE MADE FOR THE ERRORS
IN REGRESSION CONSTANTS IN OTHER FORECASTS

    DATA
      1980        2.523494E+09  1.646955E+09  3.307679E+09  2.832453E+09
      1984        3.102129E+09  2.561314E+09
```

```
EAPFOR - DATE REVISED: 10/16/80

    ANNUAL DATA FROM 1980 TO 1985
    DATA
      1980        2.584900E+08  5.358510E+08  6.020751E+08  8.411218E+08
      1984        4.822835E+08  4.655636E+08

AFRFOR - DATE REVISED: 10/16/80

    ANNUAL DATA FROM 1980 TO 1985
COMMENT:
AFRFOR = AFRFC

    DATA
      1980        4.357317E+07  1.559342E+08  1.198395E+08  8.381742E+07
      1984        1.285629E+08  1.494416E+08

LAMFOR - DATE REVISED: 10/16/80

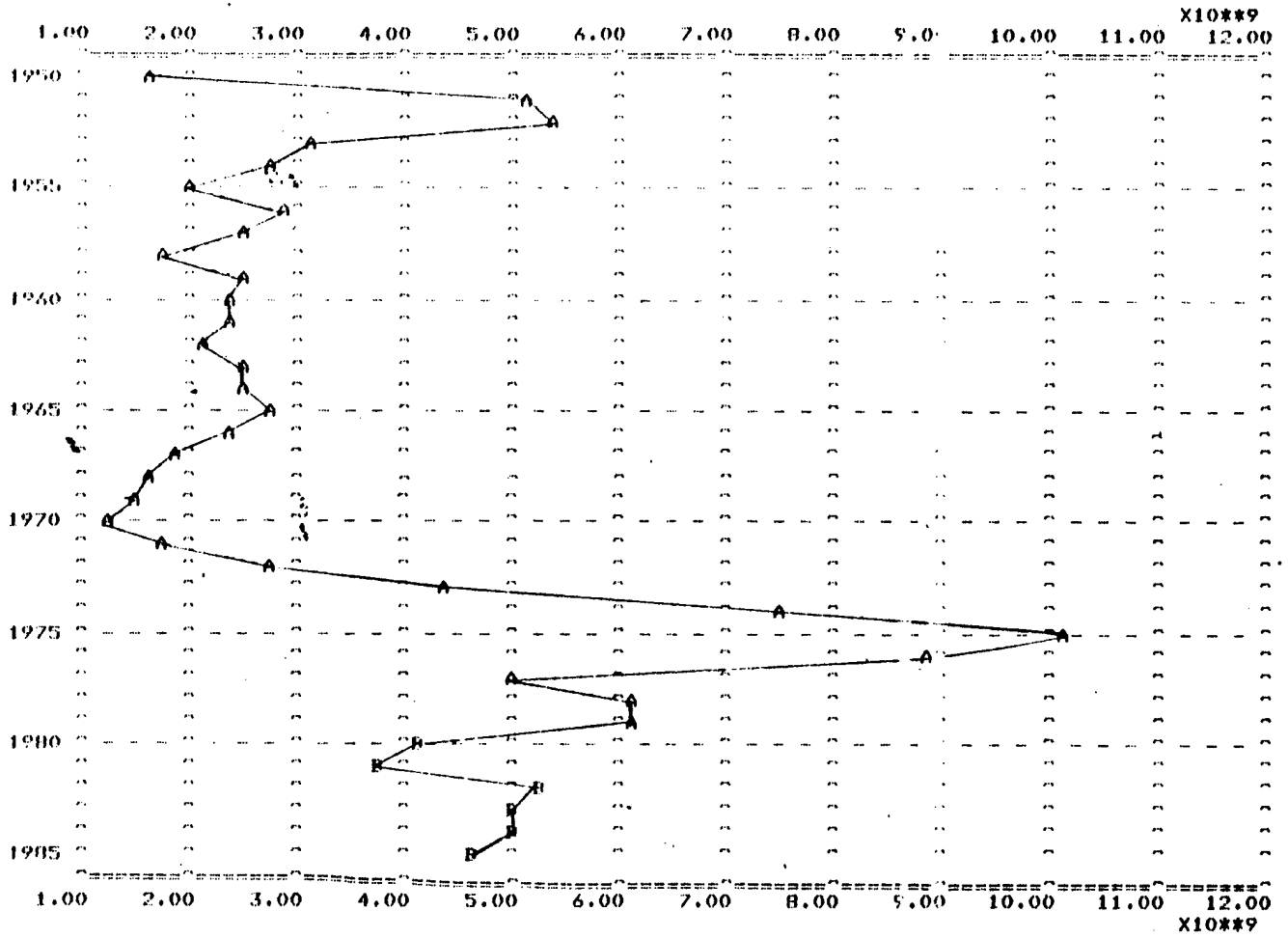
    ANNUAL DATA FROM 1980 TO 1985
COMMENT:
LAMFOR = LAMA2F80.

    DATA
      1980        4.804176E+07  9.410534E+07  9.058762E+07  4.307835E+07
      1984        3.437046E+07  3.044200E+07


ORGFOR - DATE REVISED: 10/16/80

    ANNUAL DATA FROM 1980 TO 1985
COMMENT:
ORGFOR = ORGFCT

    DATA
      1980        3.793930E+08  2.391873E+08  2.876027E+08  4.287148E+08
      1984        1.666071E+08  1.576563E+08
```

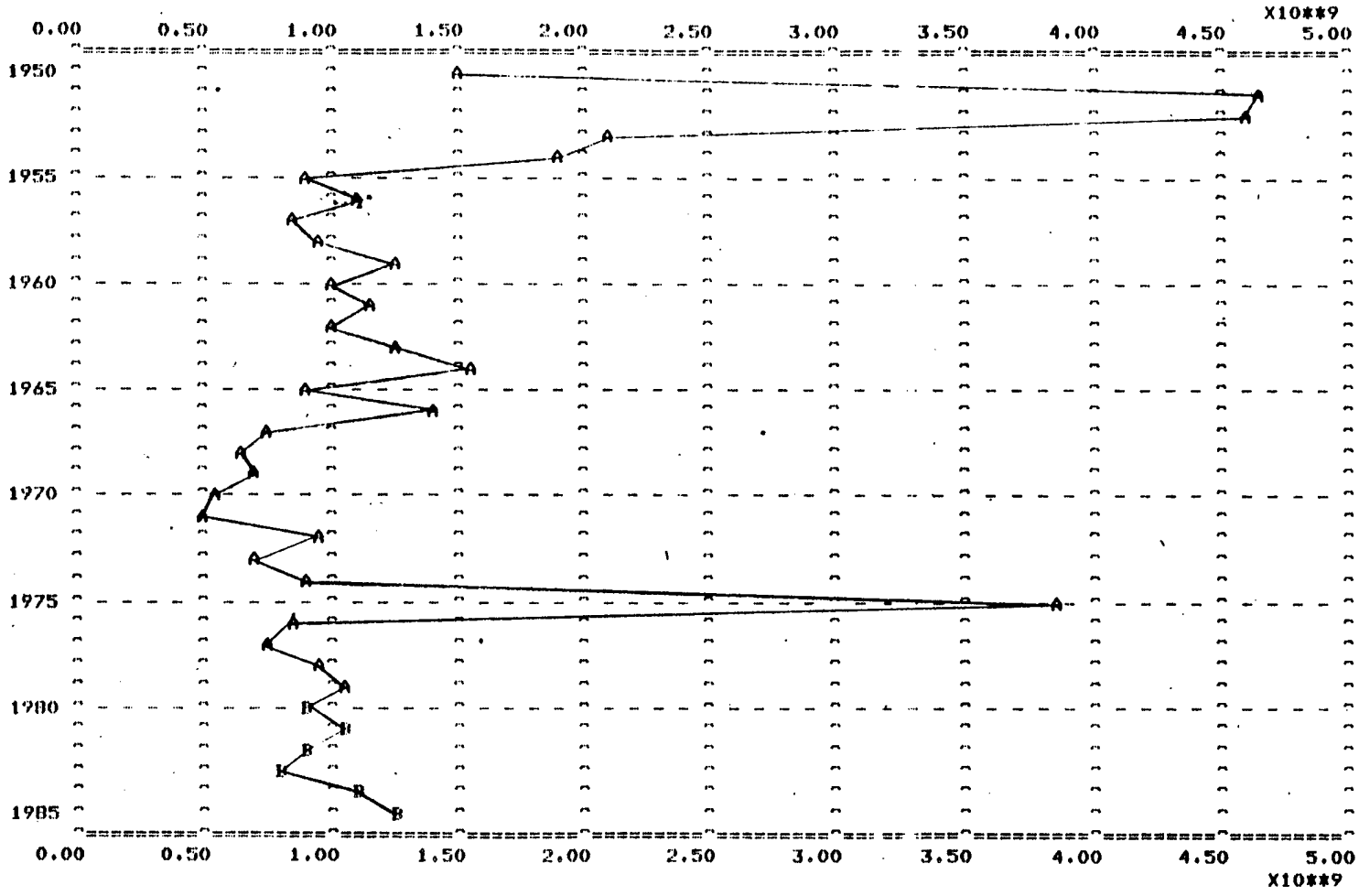


**********LEGEND**********

TIME BOUNDS: 1950 TO 1985

SYMBOL	SCALE	NAME
A	#1	WORLDSPX
B	#1	WORLDFOR

****

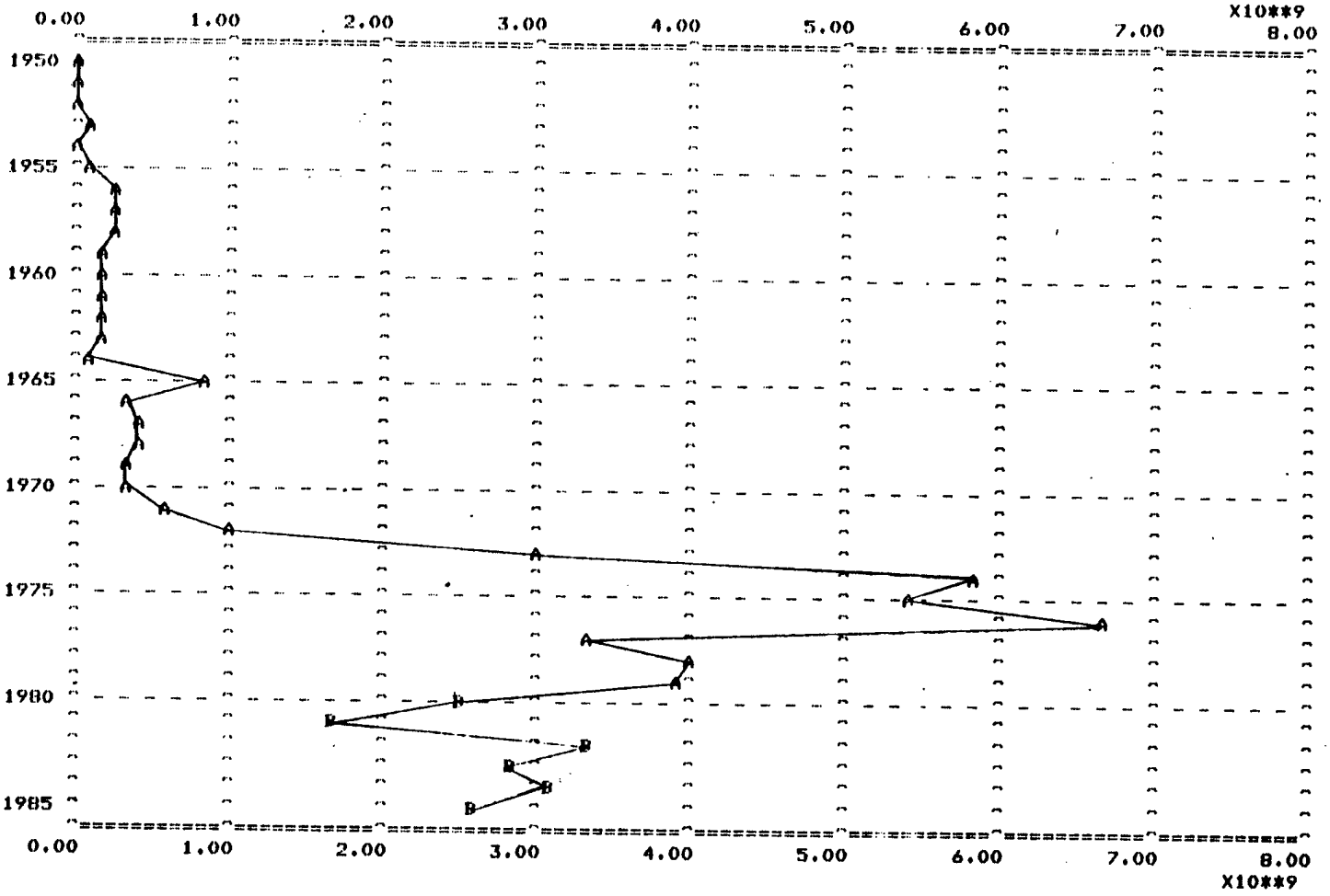


**********LEGEND**********

TIME BOUNDS: 1950 TO 1985

SYMBOL	SCALE	NAME
A	#1	EURSAPX
B	#1	EURFOR

****

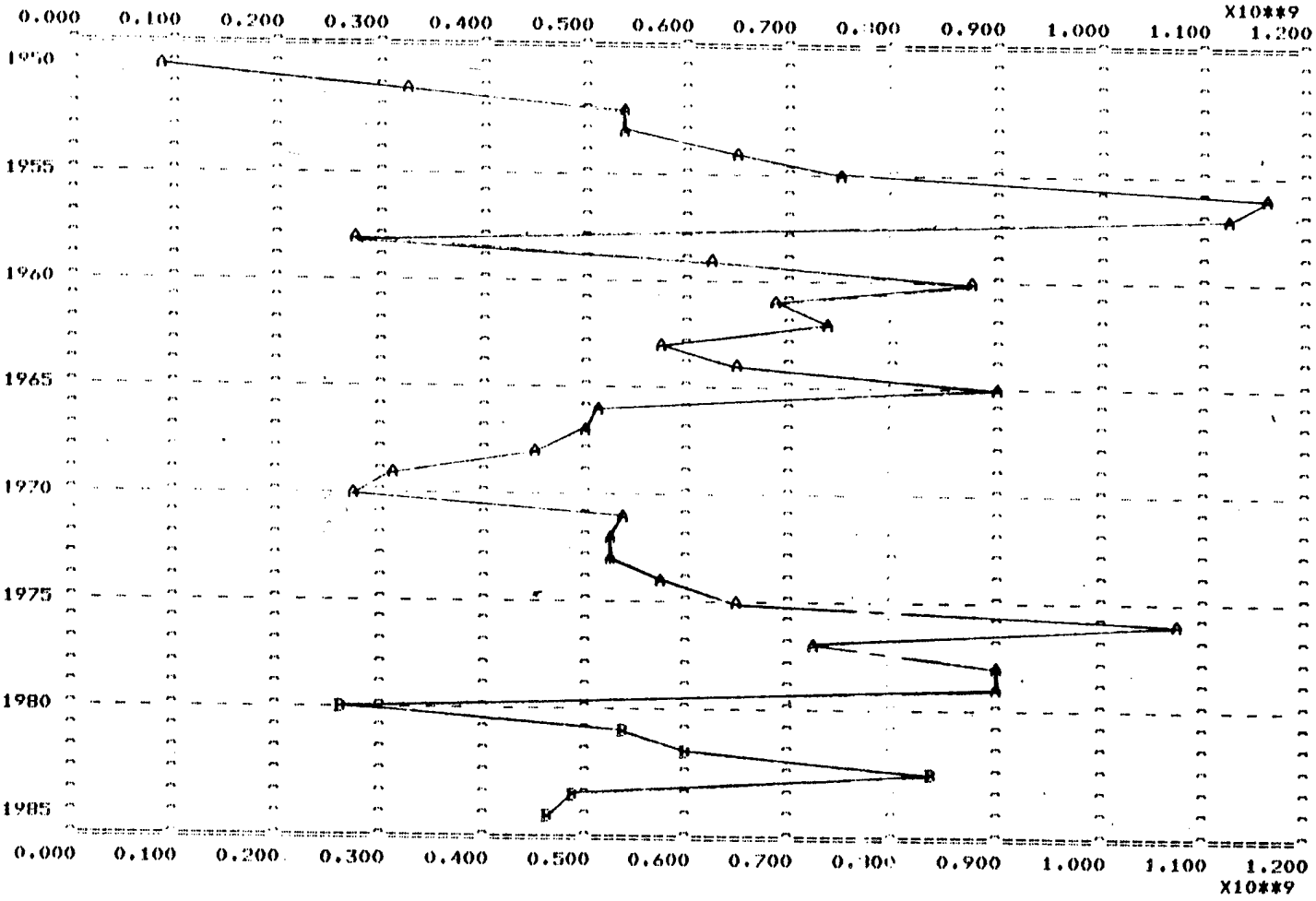


**********LEGEND********** **********

TIME BOUNDS: 1950 TO 1985

SYMBOL	SCALE	NAME
A	#1	MEASAPX
B	#1	NEAFOR

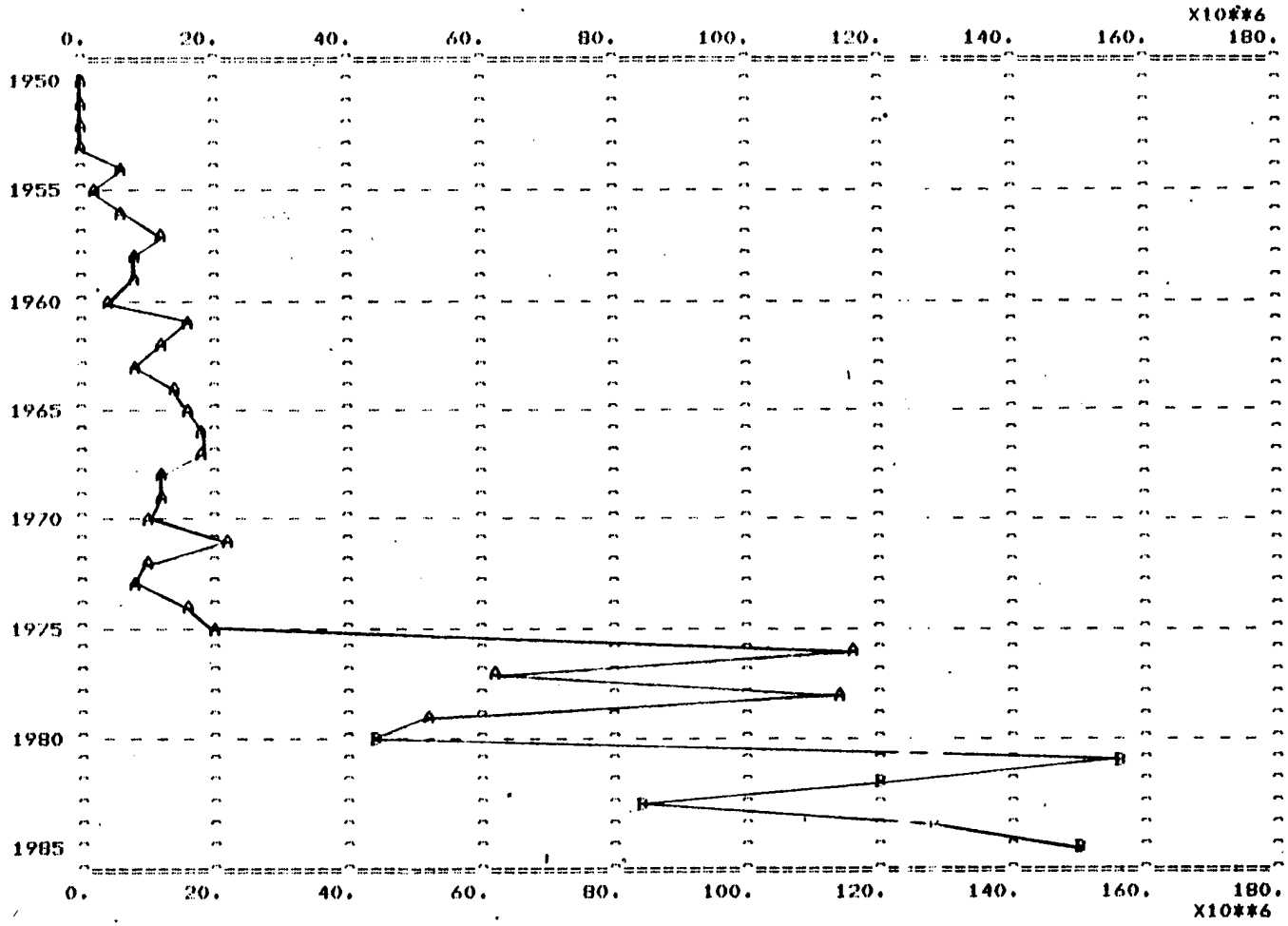
****



**********LEGEND**********

TIME BOUNDS: 1950 TO 1985

SYMBOL	SCALE	NAME
A	#1	EAPSAPX
B	#1	EAPEOR

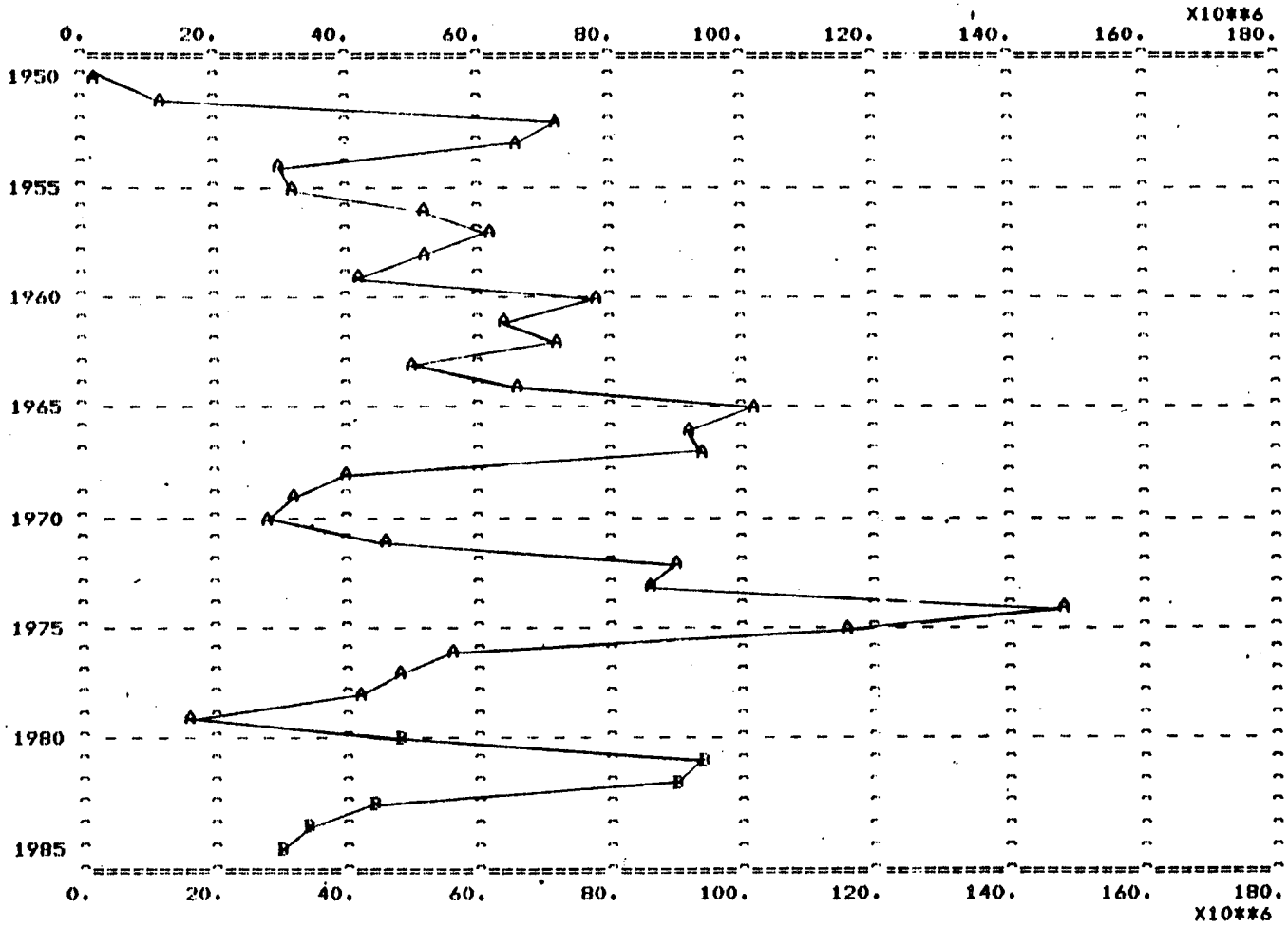


**********LEGEND**********

TIME BOUNDS: 1950 TO 1985

SYMBOL	SCALE	NAME
A	#1	AERSAFX
B	#1	AERFOR

****

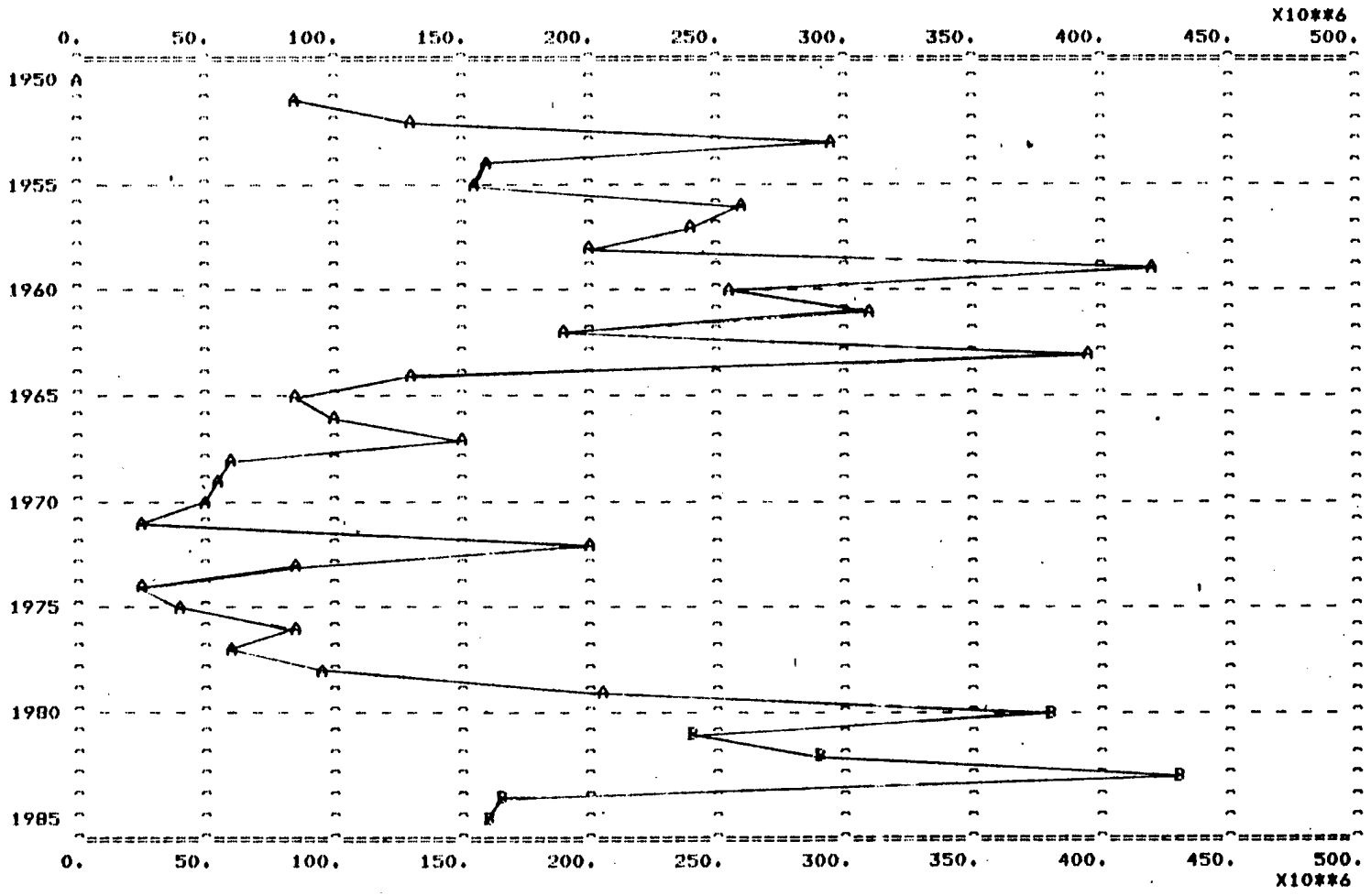


**********LEGEND**********

TIME BOUNDS: 1950 TO 1985

SYMBOL	SCALE	NAME
A	#1	LAMSAPX
B	#1	LAMFOR

****



**********LEGEND**********

TIME BOUNDS: 1950 TO 1985

SYMBOL	SCALE	NAME
A	#1	ORGSAFX
B	#1	ORGFOR

****

APPENDIX H

TOTAL SECURITY ASSISTANCE SALES
FORECAST FOR WESTERN EUROPE AND
NATO GROUP BY SERVICE FOR 1981-1985

For each regression analysis, the following statistics are generated:

NOB is the number of observations (30 for the entire period 1950-1979).

NOVAR is the number of coefficients to be determined $\sum_{i=1}^{n} (a_i) = \text{NOVAR}$.

Range is the years of data used.

RSQ is the square of the coefficient of correlation (i.e., the coefficient determination)

CSRQ is the adjusted value of the coefficient of determination.

SER is the standard error of the regression [i.e., $\sqrt{\text{SSR}/(\text{NOB} - \text{NOVAR})}$].

SSR is the sum of the squares of the differences (or residuals) between the actual values observed (LHS) and the values forecast by the test equation (RHS).

F(a/b) is the F test which measures how well the test equation fits the data.

DW(Ø) is the Durbin-Watson statistic which tests whether an autocorrelation of one-time lag is present in the residuals. If the DW range is between 1.5 and 2.5, no autocorrelation exists.

ST ER is the standard error in the values of the equation coefficient as developed by the regression.

T-STAT is the number of times the standard error in the values of the equation coefficients as determined by the regression can be divided into that value.

LHS is the left hand side or actual data observed.

RHS is the right hand side or computed data developed.

RESIDUAL is the difference between the actual data (LHS) and the computed data (RHS).

This Appendix provides expanded data in support of Figure 3.11, Total Security Assistance Sales Forecast for Western Europe and NATO by Service, 1981-1985. All values are shown in constant 1967 dollars.

- Page H-8 shows the forecast sales data by Service, 1981-1985.
- Page H-9 shows the actual sales data by Service, 1964-1979.

ARMY. Pages H-10 to H-17 illustrate the steps used to derive the Army forecast for the Western Europe and NATO Country Group

- Page H-10 shows and plots actual Army sales (ARMY1) data from 1964-1979. Note: plot scale is 10^6.
- Page H-11 shows statistics* for annual Army sales (ARMY1) and the data and plot for cumulative Army sales (ARMY1CUM).
  *The MEAN is used later in the forecast process.
- Page H-12 shows three regression equations developed for cumulative Army Sales and the regression data of ARMY1CUM using regression equation 1.
- Page H-13 is the plot of the cumulative actual data (A) against the cumulative forecast data (B) from 1964-1979 using regression equation 1.
  - The cycles around the sales value regression line appear to be of 5.5 to 6.5 years duration. The data starting in 1976 appear to be the first 4 years of a cycle. Thus, by observation, we assumed that cyclical data starting in 1968 would best provide the 1980 onward forecasts.
  - The values of the regression constant A2 in the regression equation 1 for the regression ARMY1CUM (2.88041×10^8) and the MEAN of the actual data set ARMY1 (3.261988×10^8) are very close ($\Delta = 0.4$). The values of these forecast descriptors were used to forecast 1980-1985 sales.
- Page H-14 shows the forecast and combines the actual experience of ARMY1CUM with a forecast of sales for 1980-1985 based on the 1968-1973 period.
  - Data set X11 was obtained by modifying the actual sales values for these years by the difference between the regression constant A2 and the mean.

- Data set X2 was obtained by using regression equation 2 for ARMY1CUM.
- In each case, the forecast data were extended by adding the value of the regression constant A2 to each previous value of ARMY1CUM to obtain each additional year of the projection.

- Page H-15 is a plot of data sets X11 and X2. It compares actual sales data for 1964-1979 (A) and forecast sales data for 1980-1985 (A) with the forecast sales for all years using regression equation 2.
- Page H-16 shows the actual sales data set and the forecast sales data set (equation 1) for 1964-1985 regressed using equation 3. Note: the r^2 (RSQ) is slightly improved; the standard error (SER) is slightly degraded.
- Page H-17 describes the final process, shows the forecast sales values and plots actual (A) with forecast (B) sales data.
- Page H-46 and H-47 provide a detailed explanation of each step in the process of producing the forecast. The data shown on pages H-10 through H-17 should be used with this explanation.

AIR FORCE. Pages H-18 to H-32 illustrate the steps used to develop the Air Force forecast for Western Europe and NATO.

- Page H-18 shows and plots the actual annual sales data (AF1) for 1964-1979.
- Page H-19 shows the statistics for AF1 and cumulative sales data (AF1CUM) for 1964-1979.
- Page H-20 plots the cumulative sales data (AF1CUM).
- Page H-21 shows the statistics for various year segments of AF1.
- Page H-22 shows data for three apparent cycles within the preiod 1964-1971.
- Page H-23 plots these cycles as cumulative data adjusted to the base year 1964 for comparison purposes.

- Page H-24 is the regression equation and regression data for the period 1964-1971.
- Page H-25 plots the regression data: actual cumulative sales data (A) against the forecast sales data (B).
- Page H-26 is the regression equation and regression data for the period 1964-1966 and plots the actual (A) against the forecast (B).
- Page H-27 regresses the period 1964-1968 and plots the actual (A) against the forecast (B).
- Page H-28 regresses the data on page H-27 against the data on page H-24.
- Page H-29 regresses the data on page H-26 against the data on page H-27 and plots the actual (A) against the forecast (B). Note the very high r^2 (.99999).
- Page H-30 shows AFC3FC which is the regression of AF1CUM1 on AF1CUM3 for the period 1964-1968.
  - The equation which produced the forecast is AF1CUM3 = 3.31132×10^9 + 1.32394 x AF1CUM1. If it is assumed that the AF1CUM3 experience will continue for a period of 3 years more, the extended forecast of AF1CUM3 can be produced using actual data (AF1CUM1) for the years 1969-1971 in the forecast equation. That forecast is then combined with the forecast already produced by the regression to form data set AFC3FC.
  - This series represents forecasts for the years 1975 through 1983 obtained by regression of the data set AF1CUM1 on AF1CUM3.
  - The actual sales data set AF1 indicates that additional forecast increments should be based on the years 1972-1974. The regression of AF1CUM2 on AF1CUM3 indicates that the use of 1972-1974 values directly is about as good a representation as one can get. The only question

is the magnitude of the peak value of sales to be experienced in 1983. If the experience level of 1972 were used directly as a projection, the total sales predicted in 1983 for the Western Europe and NATO Country Group would be exceeded by the sum of the Army and the Air Force sales forecasts.[1] Thus, the forecast was adjusted to permit a rational Navy sales forecast for 1983.

- Instead of accumulating the values of AF1CUM2 directly on to the cumulative value of series AFC3FC for 1971, that value (6.012719×10^9) was reduced by the amount of the Navy 1983 sales forecast (2.070385×10^8) plus the additional amount necessary (8.19632×10^7) to achieve a balance with the total Country Group forecast.
- AF1FOR1 is the complete forecast construct for the period 1975-1985. The data for the years 1975-1982 are derived from the regression of AF1CUM1 on AF1CUM3. The data for the years 1983-1985 are derived from the regression of AF1CUM2 on AF1CUM3 with an adjustment for 1983.
- AF1FOR is the Air Force sales projection for 1980-1985 obtained by subtracting prior year cumulative value from current year cumulative value.

- Page H-31 plots AF1CUM31 against AF1FOR.
- Page H-32 shows the total actual sales from 1963-1979 extended by the forecasts of AF1FOR.

[1] In all other years up to 1983, Navy sales forecasts are consistent when the total forecast for the Country Group is diminished by the sum of the Army and Air Force forecasts.

NAVY. Pages H-33 to H-39 show the steps used to develop the Navy forecast for Western Europe and NATO.

- Page H-33 shows and plots the Navy actual annual sales data for 1964-1979 (NAVY1).
- Page H-34 shows NAVY1 statistics and cumulative sales data (NAVY1CUM).
- Page H-35 plots cumulative sales data (NAVY1CUM).
- Page H-36 shows the regression of NAVY1CUM using equation 4.[1]
- Page H-37 plots the actual sales (A) of NAVY1CUM against the forecast sales (B) (NAV1FC).
  - There is no simple cyclical pattern evident.[2] Therefore, the Navy forecast was derived as the "remainder" of the Country Group forecast, $S_N = S_T - (S_A + S_{AF})$, as adjusted in 1983.
- Page H-38 shows the forecast values for all Services with explanatory comments.
- Page H-39 plots the actual sales (NAVY1) with the forecast sales (NAVY1FOR).

TOTAL. Pages H-40 to H-45 display, for each Service, actual and forecast annual sales data, actual and forecast cumulative sales data, and side by side plots for comparison.

---

[1] Note that the value of the standard error is greater than the amount of actual sales in 7 out of 16 years.

[2] It can be argued that cycles are present. For instance, the slope of the plot for 1964 and 1967 and the slope of the plot for 1975-1979 are consistent with cycles. The plots for 1968-1973 and 1974-1976 are also consistent. We have not used these arguments as a basis for the forecasts.

EURSERV

	1981	1982	1983	1984	1985
ARMY FORECAST	2.545055E+08	2.733709E+08	2.245119E+08	2.464495E+08	3.594895E+08
NAVY FORECAST	4.708224E+08	3.402460E+08	1.307231E+08	6.031401E+08	6.791872E+08
AIR FORCE FORECAST	3.272212E+08	2.642371E+08	4.445839E+08	2.485494E+08	1.969234E+08
TOTAL SERVICE FORECAST FOR W.EUROPE AND NATO	1.052549E+09	8.778540E+08	7.998188E+08	1.098139E+09	1.235600E+09

ARMY1 - DATE REVISED: 10/15/80

ANNUAL DATA FROM 1964 TO 1979
COMMENT:
ARMY SAP SALES FOR EUROPE AND CANADA COUNTRY GROUP IN CONSTANT 1967 DOLLARS

DATA

1964	7.337508E+08	3.394314E+08	2.638757E+08	2.592971E+08
1968	3.306107E+08	2.163477E+08	2.352131E+08	1.863541E+08
1972	2.082917E+08	3.213317E+08	2.562062E+08	4.397007E+08
1976	3.805990E+08	3.310254E+08	3.529270E+08	3.642199E+08

ARMY1

NOB 16 MEAN 3.261988E+08
MIN 1.863541E+08 MAX 7.337508E+08 STD. DEVIATION 1.294617E+08

NAVY1 - DATE REVISED: 10/16/80

ANNUAL DATA FROM 1964 TO 1979
COMMENT:
NAVY SAP SALES FOR EUROPE AND CANADA IN CONSTANT 1967 DOLLARS

DATA

1964	5.593746E+08	3.330120E+08	6.896942E+08	2.449485E+08
1968	1.000882E+08	8.354117E+07	9.766621E+07	9.810266E+07
1972	1.666575E+08	1.334377E+08	4.120645E+08	1.885214E+08
1976	1.492597E+08	3.807831E+08	4.072451E+08	4.891666E+08

AF1 - DATE REVISED: 10/14/80

ANNUAL DATA FROM 1964 TO 1979
COMMENT:
AIR FORCE SAP SALES FOR EUROPE AND CANADA IN CONSTANT 1967 DOLLARS

DATA

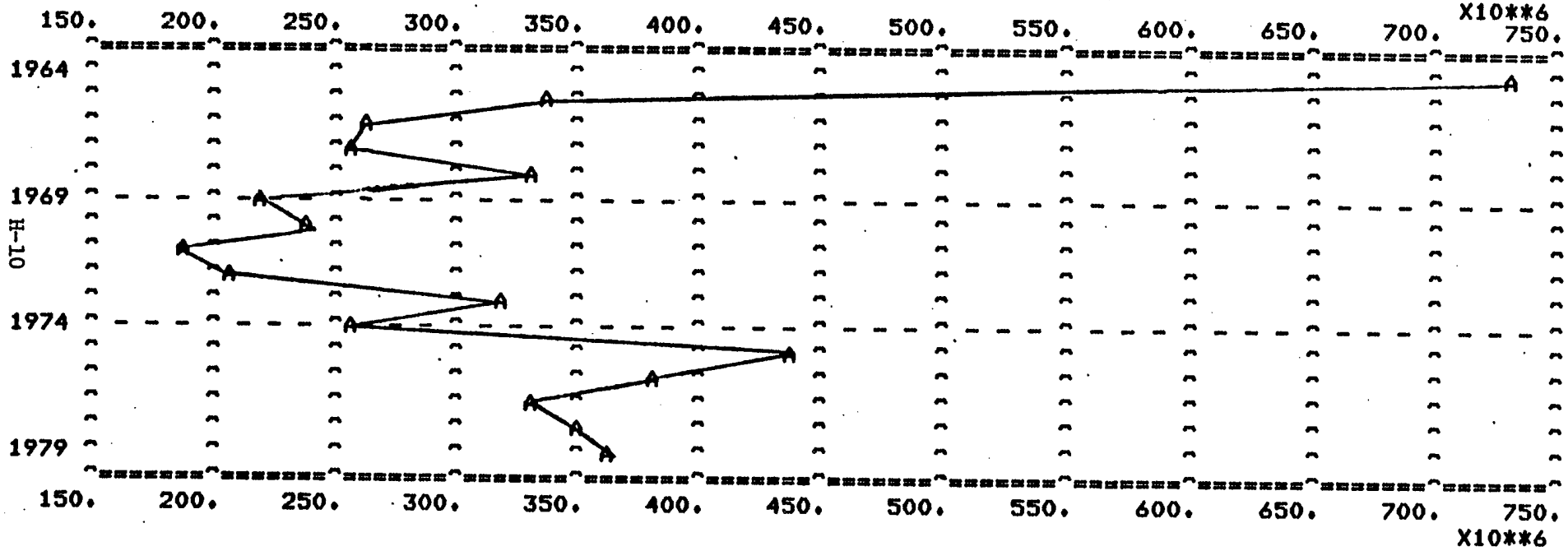
1964	2.395148E+08	2.164231E+08	4.297728E+08	2.498579E+08
1968	2.135281E+08	3.942305E+08	2.471577E+08	1.995837E+08
1972	7.335857E+08	2.485529E+08	1.969224E+08	3.550866E+09
1976	4.966971E+08	3.884524E+08	3.310950E+08	3.708639E+08

ARMY1 - DATE REVISED: 10/14/80

ANNUAL DATA FROM 1964 TO 1979
COMMENT:
ARMY SAP SALES FOR EUROPE AND CANADA COUNTRY GROUP IN CONSTANT 1967 DOLLARS

DATA

1964	7.337508E+08	3.394314E+08	2.638757E+08	2.592971E+08
1968	3.306107E+08	2.163477E+08	2.352131E+08	1.863541E+08
1972	2.082917E+08	3.213317E+08	2.562062E+08	4.397007E+08
1976	3.805990E+08	3.310254E+08	3.529270E+08	3.642199E+08



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	ARMY1

****

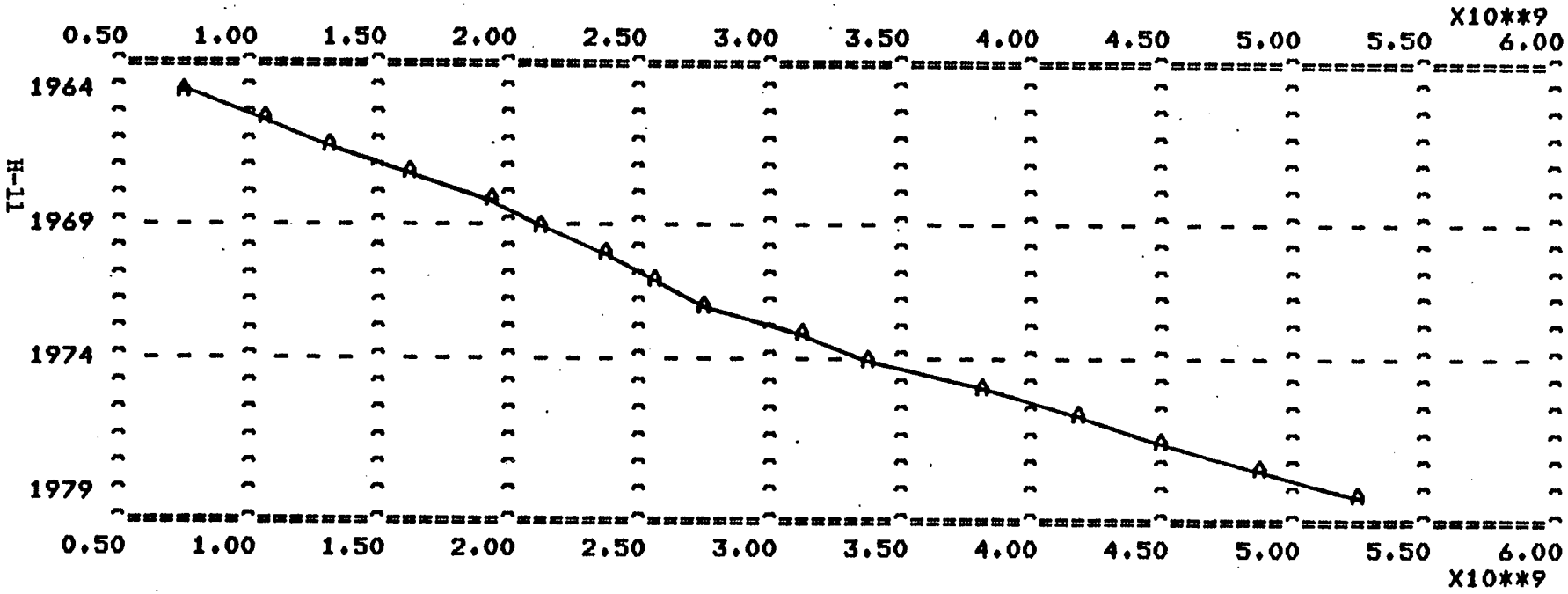
NOB 16 MEAN 3.261988E+08
MIN 1.863541E+08 MAX 7.337508E+08 STD. DEVIATION 1.294617E+08

ARMY1CUM - DATE REVISED: 10/14/80

ANNUAL DATA FROM 1964 TO 1979
COMMENT:
ARMY1CUM = CUMSUM(ARMY1)

DATA

1964	7.337508E+08	1.073182E+09	1.337058E+09	1.596355E+09
1968	1.926966E+09	2.143313E+09	2.378526E+09	2.564880E+09
1972	2.773172E+09	3.094503E+09	3.350710E+09	3.790410E+09
1976	4.171009E+09	4.502032E+09	4.854956E+09	5.219172E+09



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL SCALE NAME
A #1 ARMY1CUM

COEFFICIENT:
A1 A2 A3

EQUATIONS

1: ARMY1CUM = A1+A2*TIM

2: X1 = A1+A2*TIM

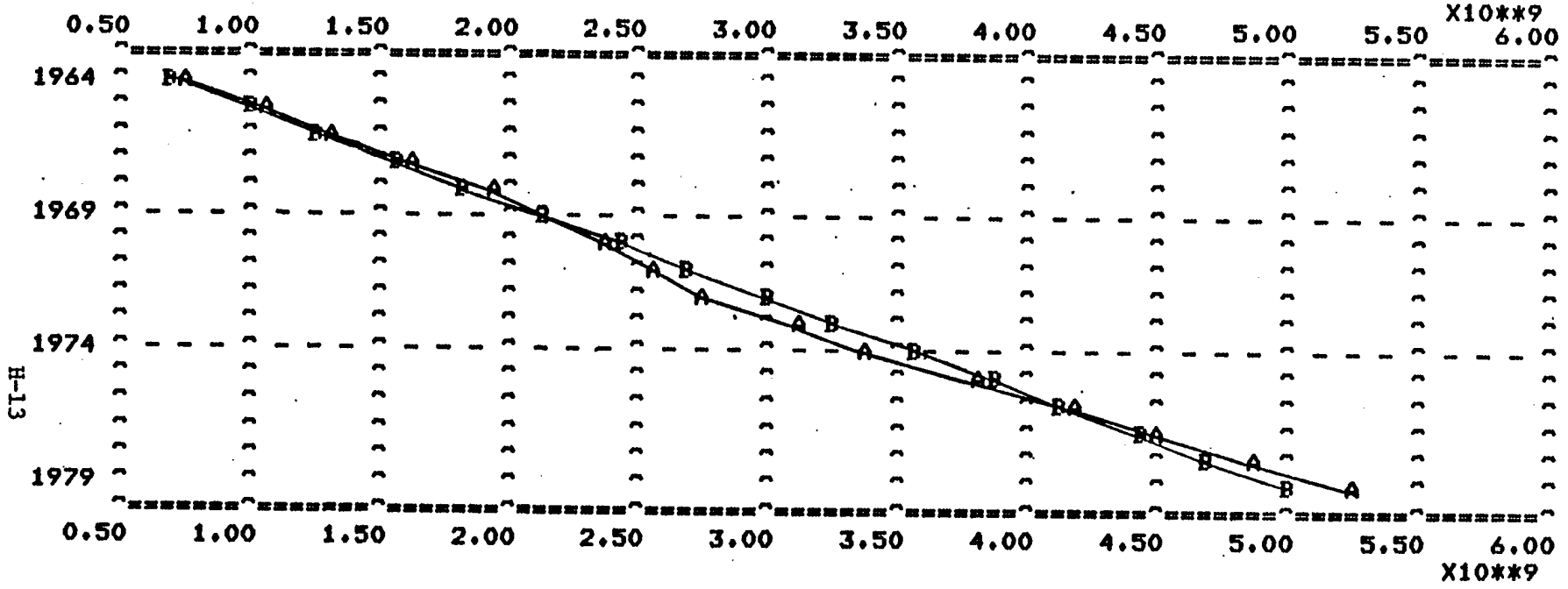
3: X11 = A1+A2*TIM

1: ARMY1CUM = A1+A2*TIM

NOB = 16 NOVAR = 2
RANGE = 1964 TO 1979
RSQ = 0.99123 CRSQ = 0.99061 F(1/14) = 1583.240
SER = 1.33E+08 SSR = 2.494E+17 DW(0) = 0.30

COEF	VALUE	ST ER	T-STAT
A1	-3.63656E+09	1.66262E+08	-21.87250
A2	2.88041E+08	7.23906E+06	39.78990

DATE	LHS	RHS	RESIDUAL
1964	7.337508E+08	6.840586E+08	4.969216E+07
1965	1.073182E+09	9.721016E+08	1.010806E+08
1966	1.337058E+09	1.260141E+09	7.691725E+07
1967	1.596355E+09	1.548184E+09	4.817126E+07
1968	1.926966E+09	1.836222E+09	9.074304E+07
1969	2.143313E+09	2.124265E+09	1.904768E+07
1970	2.378526E+09	2.412308E+09	-3.378227E+07
1971	2.564880E+09	2.700347E+09	-1.354673E+08
1972	2.773172E+09	2.988390E+09	-2.152187E+08
1973	3.094503E+09	3.276433E+09	-1.819300E+08
1974	3.350710E+09	3.564472E+09	-2.137628E+08
1975	3.790410E+09	3.852515E+09	-6.210509E+07
1976	4.171009E+09	4.140554E+09	3.045504E+07
1977	4.502032E+09	4.428595E+09	7.343718E+07
1978	4.854956E+09	4.716638E+09	1.383178E+08
1979	5.219172E+09	5.004677E+09	2.144952E+08



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	ARMY1CUM
B	#1	ARMY1FC

****

X11 - DATE REVISED: 10/14/80

ANNUAL DATA FROM 1964 TO 1985
COMMENT:
X11 = COMBINE(ARMY1CUM,X11)

DATA

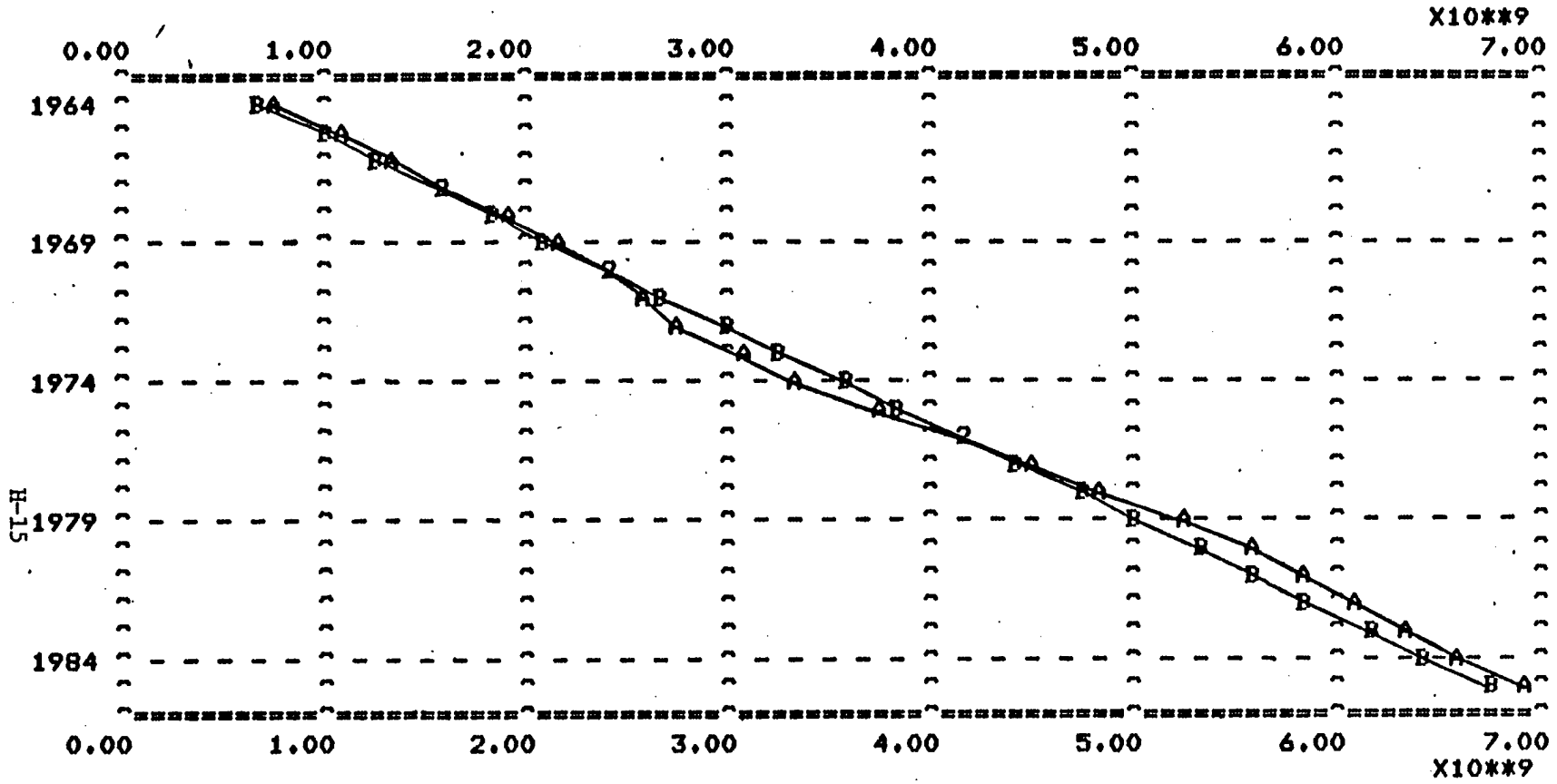
1964	7.337508E+08	1.073182E+09	1.337058E+09	1.596355E+09
1968	1.926966E+09	2.143313E+09	2.378526E+09	2.564880E+09
1972	2.773172E+09	3.094503E+09	3.350710E+09	3.790410E+09
1976	4.171009E+09	4.502032E+09	4.854956E+09	5.219172E+09
1980	5.587939E+09	5.842444E+09	6.115815E+09	6.340325E+09
1984	6.586778E+09	6.946267E+09		

X2 - DATE REVISED: 10/14/80

ANNUAL DATA FROM 1964 TO 1985
COMMENT:
X2 IS OBTAINED BY USING THE REGRESSION EQUATION TO FORECAST
PAST AND FUTURE EVENTS

DATA

1964	6.840522E+08	9.720952E+08	1.260134E+09	1.548177E+09
1968	1.836216E+09	2.124259E+09	2.412298E+09	2.700341E+09
1972	2.988380E+09	3.276423E+09	3.564462E+09	3.852505E+09
1976	4.140544E+09	4.428583E+09	4.716622E+09	5.004665E+09
1980	5.292704E+09	5.580747E+09	5.868786E+09	6.156829E+09
1984	6.444868E+09	6.732911E+09		



**********LEGEND**********

TIME BOUNDS: 1964 TO 1985

SYMBOL	SCALE	NAME
A	#1	X11
B	#1	X2

****

3: X11 = A1+A2*TIM

NOB = 22 NOVAR = 2
RANGE = 1964 TO 1985
RSQ = 0.99546 CRSQ = 0.99523 F(1/20) = 4381.34
SER = 1.35E+08 SSR = 3.631E+17 DW(0) = 0.26

COEF	VALUE	ST ER	T-STAT
A1	-3.87285E+09	1.18978E+08	-32.55090
A2	2.99701E+08	4.52778E+06	66.19160

DATE	LHS	RHS	RESIDUAL
1964	7.337508E+08	6.226598E+08	1.110909E+08
1965	1.073182E+09	9.223642E+08	1.508180E+08
1966	1.337058E+09	1.222064E+09	1.149934E+08
1967	1.596355E+09	1.521765E+09	7.459021E+07
1968	1.926966E+09	1.821465E+09	1.055007E+08
1969	2.143313E+09	2.121165E+09	2.214810E+07
1970	2.378526E+09	2.420865E+09	-4.233907E+07
1971	2.564880E+09	2.720570E+09	-1.556895E+08
1972	2.773172E+09	3.020270E+09	-2.470981E+08
1973	3.094503E+09	3.319970E+09	-2.254666E+08
1974	3.350710E+09	3.619670E+09	-2.689608E+08
1975	3.790410E+09	3.919370E+09	-1.289603E+08
1976	4.171009E+09	4.219075E+09	-4.806554E+07
1977	4.502032E+09	4.518773E+09	-1.674035E+07
1978	4.854956E+09	4.818473E+09	3.648307E+07
1979	5.219172E+09	5.118173E+09	1.009992E+08
1980	5.587939E+09	5.417873E+09	1.700659E+08
1981	5.842444E+09	5.717578E+09	1.248666E+08
1982	6.115815E+09	6.017278E+09	9.853747E+07
1983	6.340325E+09	6.316978E+09	2.334720E+07
1984	6.586778E+09	6.616678E+09	-2.990080E+07
1985	6.946267E+09	6.916379E+09	2.988851E+07

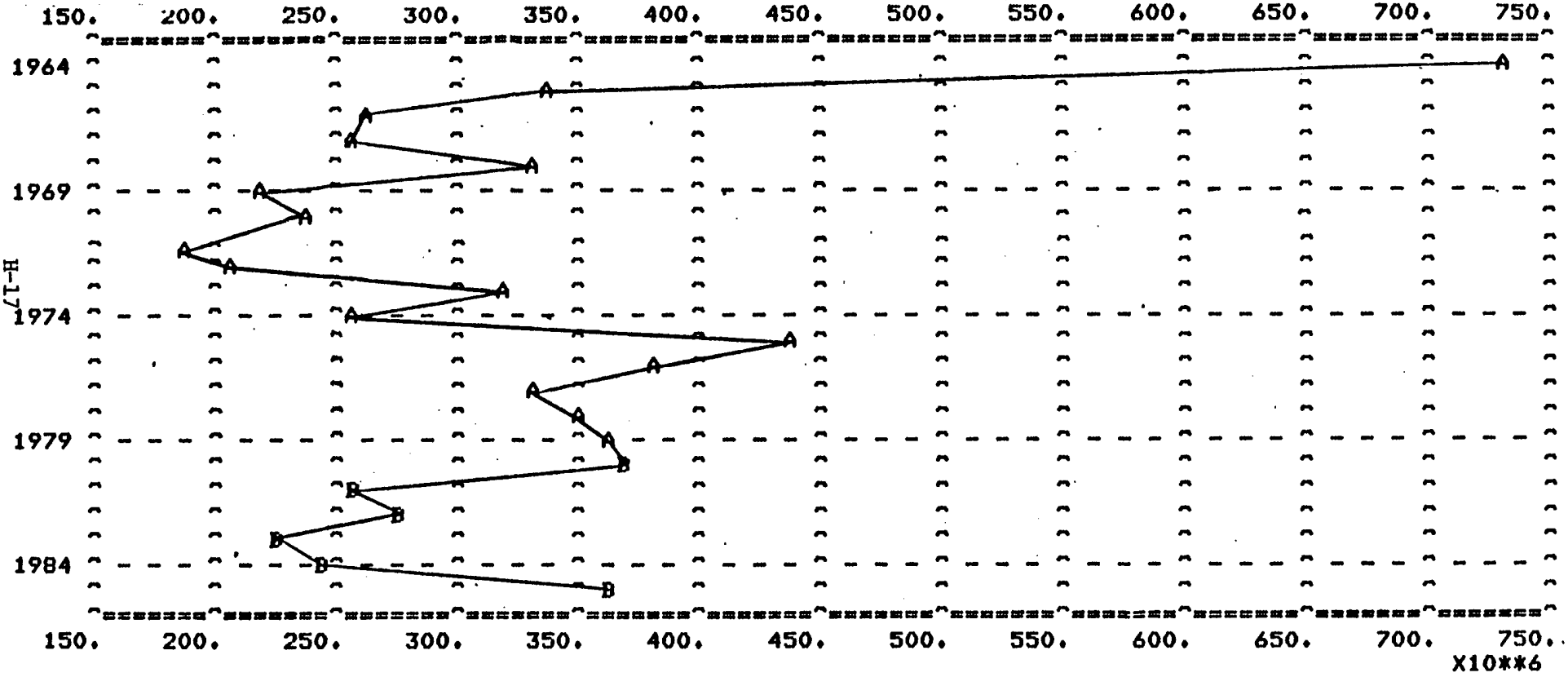
[redacted]

ANNUAL DATA FROM 1980 TO 1985

COMMENT:
THE DIFFERENCE BETWEEN THE MEAN OF THE VECTOR ARMY1 AND THE CONSTANT A2 AS DERIVED IN THE REGRESSION OF THE CUMULATIVE OF ARMY1 IS USED TO MODIFY THE VALUES OF ARMY1 BASED ON THE CYCLES DISPLAYED IN THE REGRESSION:THE EQUATION IS ARMY1-(REGRESSION CONSTANT A2)+MEAN OF ARMY1)=ARM1FOR

DATA

1980	3.687685E+08	2.545055E+08	2.733709E+08	2.245119E+08
1984	2.464495E+08	3.594895E+08		



**********LEGEND**********

TIME BOUNDS: 1964 TO 1985

SYMBOL	SCALE	NAME
A	#1	ARMY1
B	#1	ARM1FOR

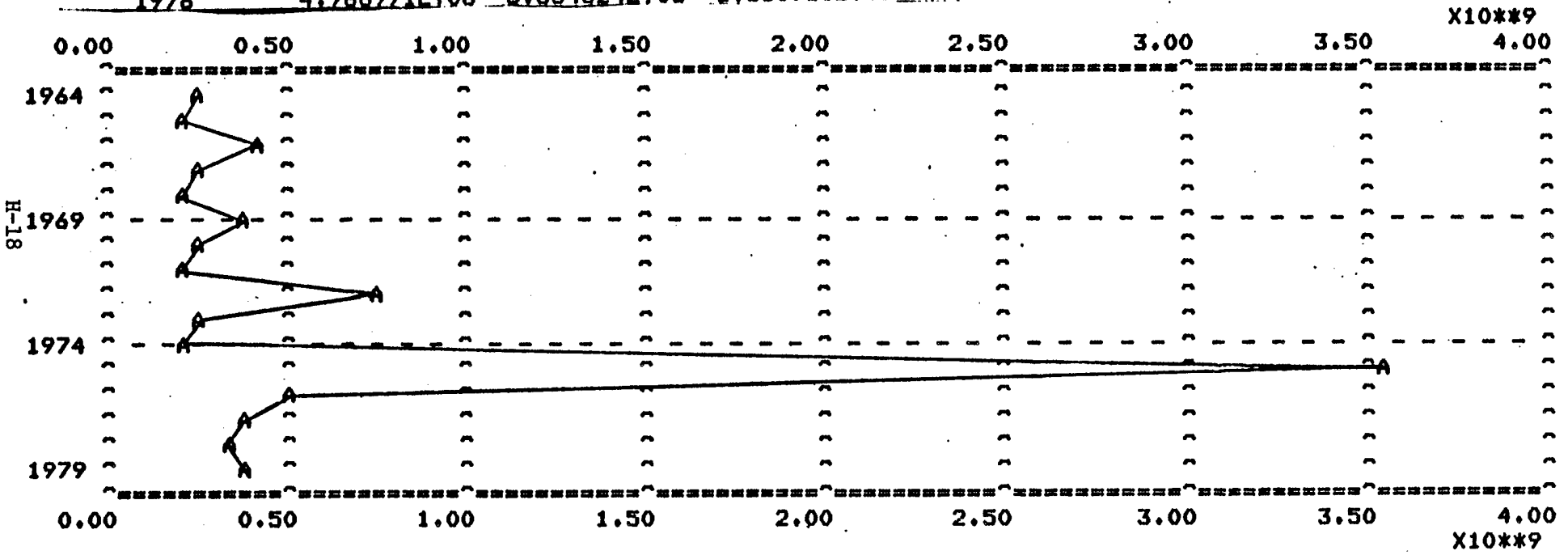
AF1 - DATE REVISED: 10/14/80

ANNUAL DATA FROM 1964 TO 1979

COMMENT:
AIR FORCE SAP SALES FOR EUROPE AND CANADA IN CONSTANT 1967 DOLLARS

DATA

1964	2.395148E+08	2.164231E+08	4.297728E+08	2.498579E+08
1968	2.135281E+08	3.942305E+08	2.471577E+08	1.995837E+08
1972	7.335857E+08	2.485529E+08	1.969224E+08	3.550866E+09
1976	4.966971E+08	3.884524E+08	3.310950E+08	3.708639E+08



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	AF1

```
AF1
     NOB 16                MEAN     5.316938E+08
     MIN   1.969224E+08 MAX      3.550866E+09  STD. DEVIATION   8.174029E+0

AF1CUM - DATE REVISED: 10/14/80

    ANNUAL DATA FROM 1964 TO 1979
COMMENT:
AF1CUM = CUMSUM(AF1)

    DATA
      1964        2.395148E+08  4.559378E+08  8.857106E+08  1.135568E+09
      1968        1.349096E+09  1.743327E+09  1.990484E+09  2.190068E+09
      1972        2.923654E+09  3.172206E+09  3.369129E+09  6.919991E+09
      1976        7.416685E+09  7.805137E+09  8.136229E+09  8.507089E+09
```

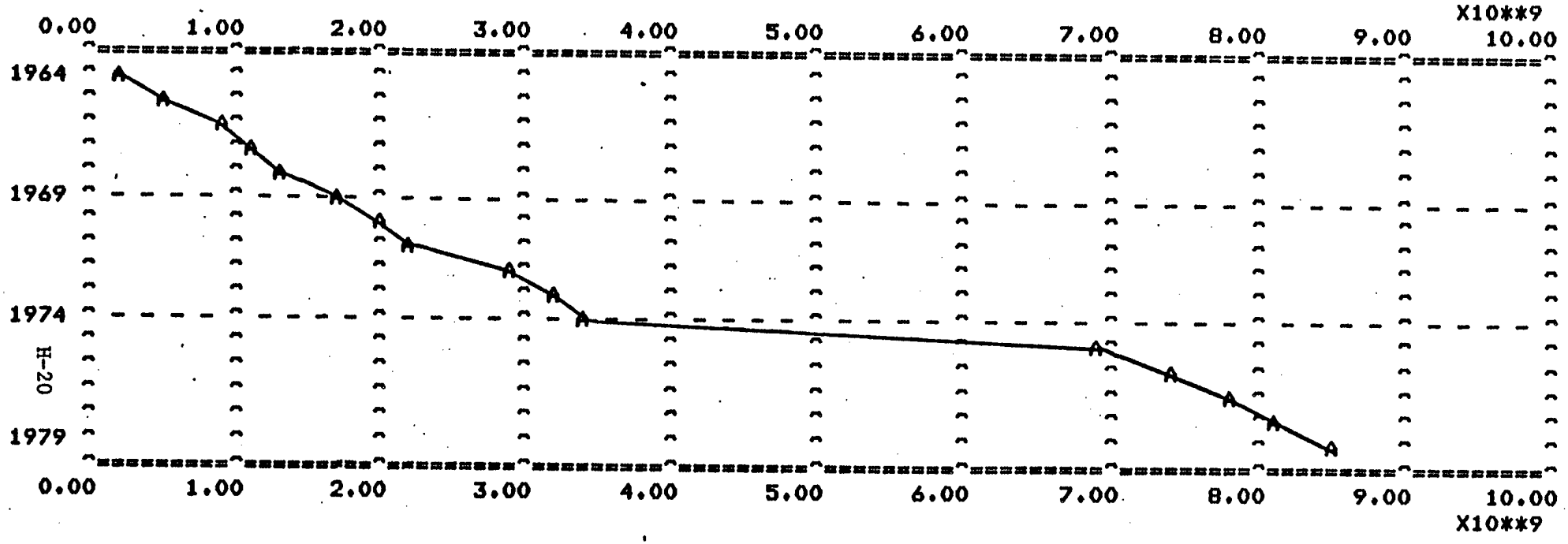
```
5:      AF1CUM1 = A1+A2*TIM

6:      AF1CUM2 = A1+A2*TIM

7:      AF1CUM3 = A1+A2*TIM

8:      AF1CUM3 = A1+A2*AF1CUM2

9:      AF1CUM3 = A1+A2*AF1CUM1
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	AF1CUM

****

```
      range 1964 to 1974
AF1
     NOB 11                MEAN     3.062843E+08
     MIN    1.969224E+08   MAX      7.335857E+08  STD. DEVIATION    1.612653E+08

               .doranse 1974 to 1979;do stats(af1);
AF1
     NOB 6                 MEAN     8.891494E+08
     MIN    1.969224E+08   MAX      3.550866E+09  STD. DEVIATION    1.307568E+09

               .doranse 1975 to 1979;do stats(af1);
AF1
     NOB 5                 MEAN     1.027595E+09
     MIN    3.310950E+08   MAX      3.550866E+09  STD. DEVIATION    1.411883E+09

               .doranse 1964 to 1971;do stats(af1);
AF1
     NOB 8                 MEAN     2.737585E+08
     MIN    1.995837E+08   MAX      4.297728E+08  STD. DEVIATION    8.760493E+07

               .doranse 1972 to 1974;do stats(af1);
AF1
     NOB 3                 MEAN     3.930202E+08
     MIN    1.969224E+08   MAX      7.335857E+08  STD. DEVIATION    2.960655E+08

                                    doranse 1975 to 1979;do stats(af1);
AF1
     NOB 5                 MEAN     1.027595E+09
     MIN    3.310950E+08   MAX      3.550866E+09  STD. DEVIATION    1.411883E+09
```

```
AF1CUM1 - DATE REVISED: 10/14/80

    ANNUAL DATA FROM 1964 TO 1971
COMMENT:
AF1CUM1 = CUMSUM(AF1)

    DATA
      1964        2.395148E+08  4.559378E+08  8.857106E+08  1.135568E+09
      1968        1.349096E+09  1.743327E+09  1.990484E+09  2.190068E+09

AF1CUM2 - DATE REVISED: 10/14/80

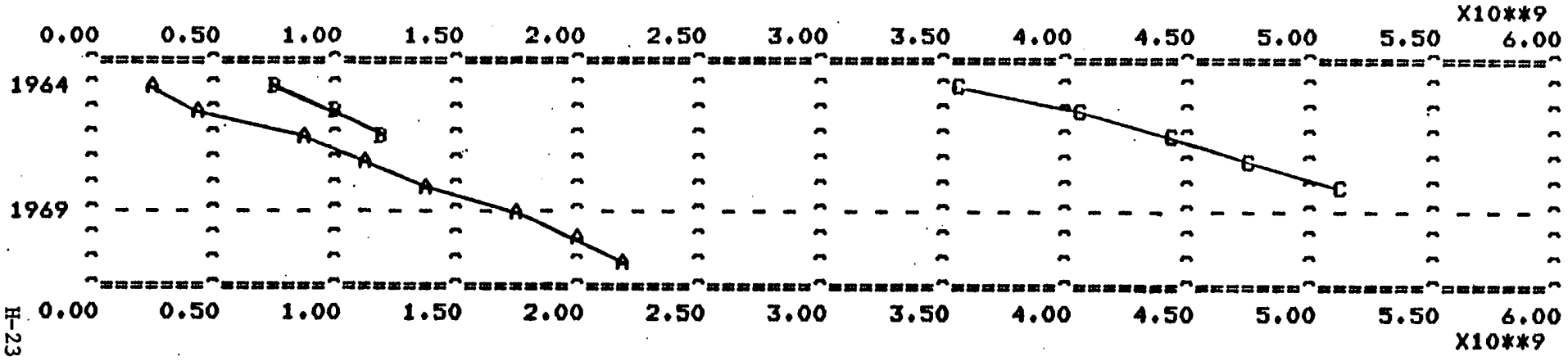
    ANNUAL DATA FROM 1964 TO 1966
COMMENT:
AF1CUM2 = CUMSUM(AF1)

    DATA
      1964        7.335857E+08  9.821384E+08  1.179061E+09

AF1CUM3 - DATE REVISED: 10/14/80

    ANNUAL DATA FROM 1964 TO 1968
COMMENT:
AF1CUM3 = CUMSUM(AF1)

    DATA
      1964        3.550866E+09  4.047563E+09  4.436013E+09  4.767105E+09
      1968        5.137965E+09
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1971

SYMBOL	SCALE	NAME
A	#1	AF1CUM1
B	#1	AF1CUM2
C	#1	AF1CUM3

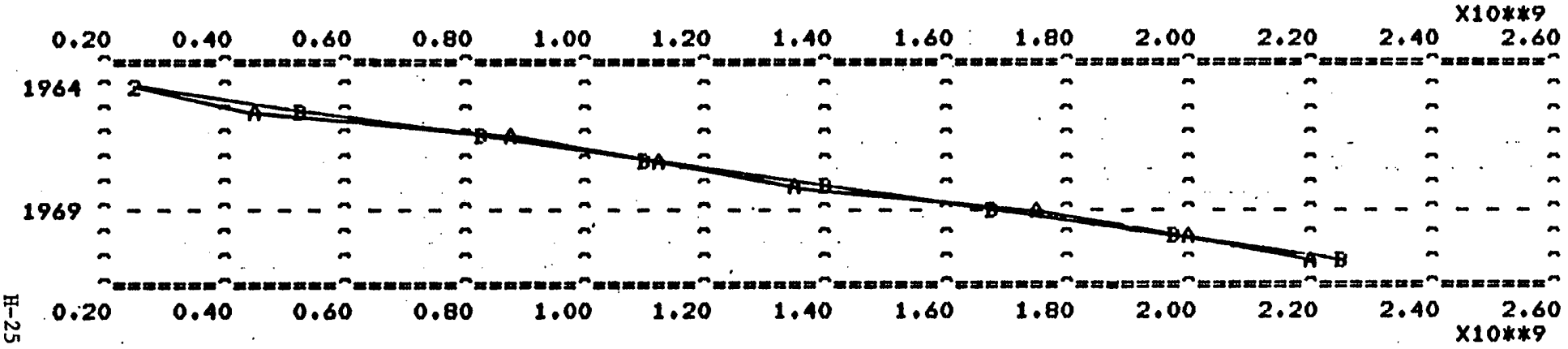
****

5: AF1CUM1 = A1+A2*TIM

NOB = 8 NOVAR = 2
RANGE = 1964 TO 1971
RSQ = 0.99377 CRSQ = 0.99273 F(1/6) = 956.41
SER = 6.02E+07 SSR = 2.171E+16 DW(0) = 2.44

COEF	VALUE	ST ER	T-STAT
A1	-4.06188E+09	1.73032E+08	-23.47480
A2	2.87059E+08	9.28214E+06	30.92600

DATE	LHS	RHS	RESIDUAL
1964	2.395148E+08	2.440023E+08	-4.487504E+06
1965	4.559378E+08	5.310623E+08	-7.512448E+07
1966	8.857106E+08	8.181181E+08	6.759245E+07
1967	1.135568E+09	1.105178E+09	3.039027E+07
1968	1.349096E+09	1.392238E+09	-4.314163E+07
1969	1.743327E+09	1.679298E+09	6.402893E+07
1970	1.990484E+09	1.966358E+09	2.412646E+07
1971	2.190068E+09	2.253414E+09	-6.334592E+07



**********LEGEND**********

TIME BOUNDS: 1964 TO 1971

SYMBOL	SCALE	NAME
A	#1	AF1CUM1
B	#1	AFC1FC1

****

```
6:  AF1CUM2 = A1+A2*TIM

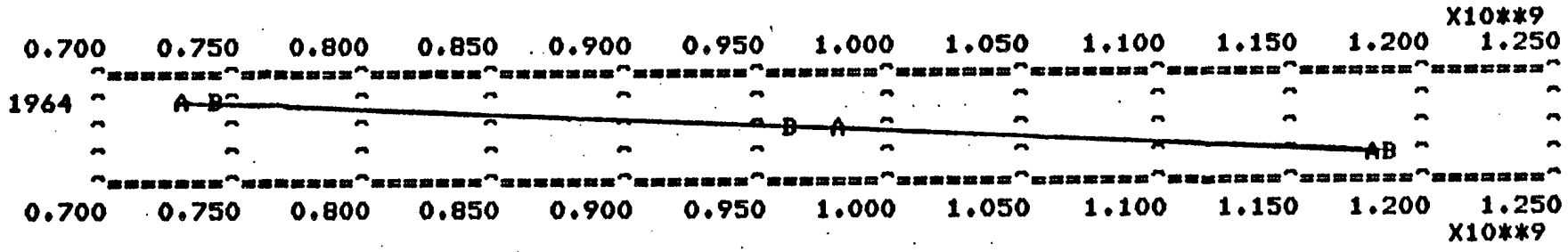

NOB = 3      NOVAR = 2
RANGE =  1964 TO 1966
RSQ =    0.99554      CRSQ =    0.99109      F(1/1) =    223.34
SER = 2.11E+07        SSR = 4.443E+14        DW(0) =  3.00

COEF            VALUE           ST ER          T-STAT

A1         -2.59887E+09     2.38780E+08       -10.88400
A2          2.22738E+08     1.49043E+07        14.94450


 DATE           LHS             RHS            RESIDUAL

1964         7.335857E+08    7.421896E+08   -8.603904E+06
1965         9.821384E+08    9.649272E+08    1.721114E+07
1966         1.179061E+09    1.187665E+09   -8.603904E+06
```




```
**********LEGEND**********

TIME BOUNDS: 1964 TO 1966

SYMBOL SCALE NAME
   A     #1   AF1CUM2
   B     #1   AFC1FC2

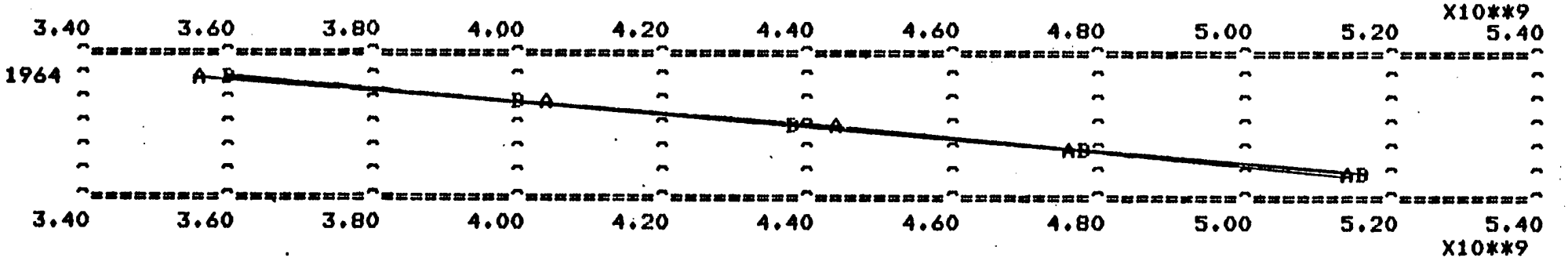
**********
```

7: AF1CUM3 = A1+A2*TIM

NOB = 5 NOVAR = 2
RANGE = 1964 TO 1968
RSQ = 0.99407 CRSQ = 0.9921 F(1/3) = 503.01
SER = 5.49E+07 SSR = 9.043E+15 DW(0) = 1.69

COEF	VALUE	ST ER	T-STAT
A1	-2.23146E+09	2.96169E+08	-7.53439
A2	3.89374E+08	1.73618E+07	22.42710

DATE	LHS	RHS	RESIDUAL
1964	3.550866E+09	3.609153E+09	-5.828710E+07
1965	4.047563E+09	3.998527E+09	4.903603E+07
1966	4.436013E+09	4.387897E+09	4.811571E+07
1967	4.767105E+09	4.777271E+09	-1.016627E+07
1968	5.137965E+09	5.166645E+09	-2.868019E+07



**********LEGEND**********

TIME BOUNDS: 1964 TO 1968

SYMBOL	SCALE	NAME
A	#1	AF1CUM3
B	#1	AFC1FC3

****

```
9:  AF1CUM3 = A1+A2*AF1CUM1

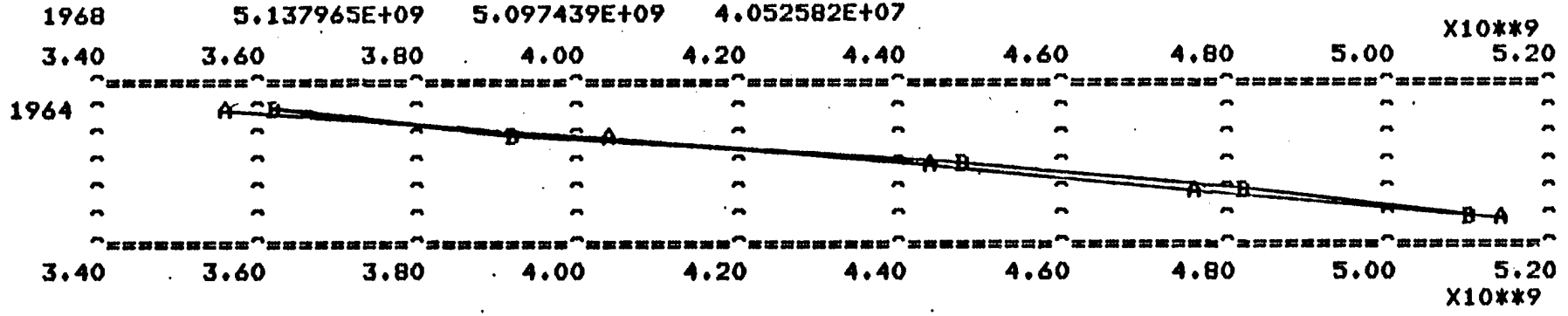
NOB = 5      NOVAR = 2
RANGE =  1964 TO 1968
RSQ =   0.98046      CRSQ =   0.97394      F(1/3) =   150.50
SER = 9.97E+07       SSR = 2.98:E+16       DW(0) =  2.84

COEF            VALUE           ST ER          T-STAT

A1          3.31132E+09     9.84320E+07        33.64070
A2              1.32394         0.10792        12.26750


 DATE            LHS             RHS           RESIDUAL

1964         3.550866E+09    3.628423E+09   -7.755699E+07
1965         4.047563E+09    3.914954E+09    1.326090E+08
1966         4.436013E+09    4.483944E+09   -4.793139E+07
1967         4.767105E+09    4.814742E+09   -4.763648E+07
1968         5.137965E+09    5.097439E+09    4.052582E+07
```




```
**********LEGEND**********

TIME BOUNDS: 1964 TO 1968

SYMBOL SCALE NAME
   A    #1   AF1CUM3
   B    #1   AF1C3FC

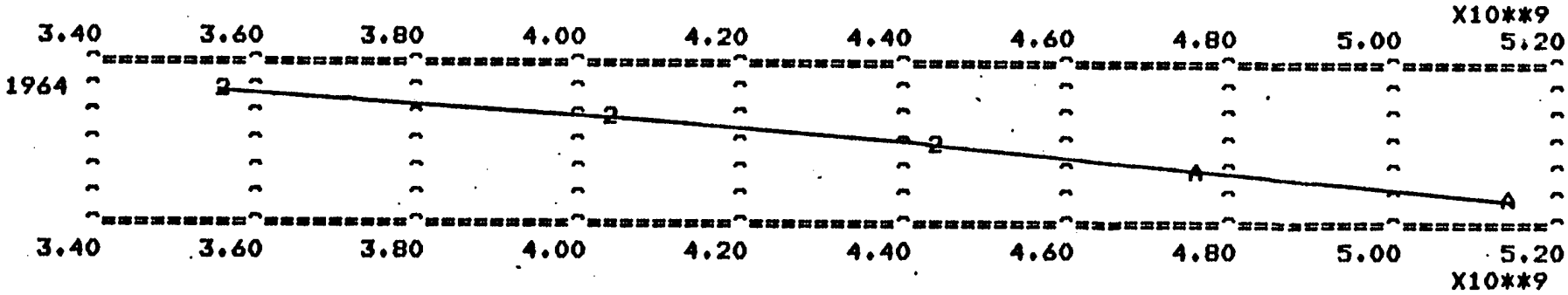
**********
```

8: AF1CUM3 = A1+A2*AF1CUM2

NOB = 3 NOVAR = 2
RANGE = 1964 TO 1966
RSQ = 0.99999 CRSQ = 0.99997 F(1/1) = 7.42E+04
SER = 2.30E+06 SSR = 5.307E+12 DW(0) = 2.99

COEF	VALUE	ST ER	T-STAT
A1	2.09372E+09	7.16572E+06	292.18600
A2	1.98746	0.00730	272.36300

DATE	LHS	RHS	RESIDUAL
1964	3.550866E+09	3.551696E+09	-830208.
1965	4.047563E+09	4.045685E+09	1.878016E+06
1966	4.436013E+09	4.437058E+09	-1.044480E+06



**********LEGEND**********

TIME BOUNDS: 1964 TO 1968

SYMBOL	SCALE	NAME
A	#1	AF1CUM3
B	#1	AF1C3FC2

****

```
AFC3FC - DATE REVISED: 10/14/80

    ANNUAL DATA FROM 1964 TO 1971
COMMENT:
AFC3FC = COMBINE(AF1C3FC,AFC3FC)

    DATA
      1964        3.628423E+09  3.914954E+09  4.483944E+09  4.814742E+09
      1968        5.097439E+09  5.421261E+09  5.748482E+09  6.012719E+09

AFC3FC1 - DATE REVISED: 10/14/80

    ANNUAL DATA FROM 1964 TO 1966
COMMENT:
AFC3FC1 = AF1CUM2+5.723718E09

    DATA
      1964        6.457303E+09  6.705852E+09  6.902776E+09

AF1FOR1- DATE REVISED: 10/14/80

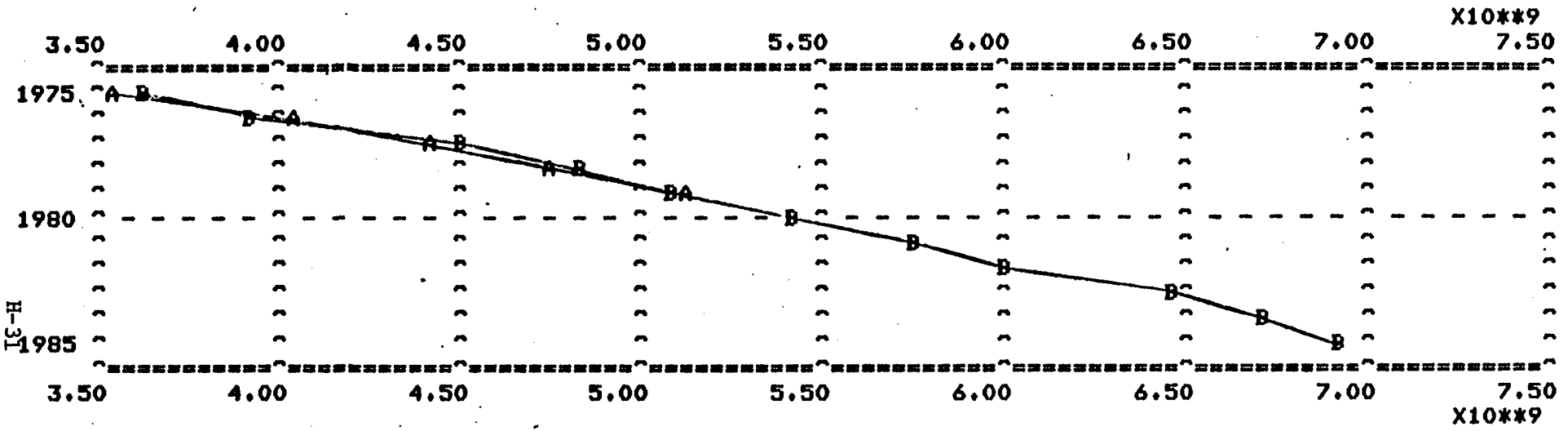
    ANNUAL DATA FROM 1975 TO 1985
COMMENT:
AF1FOR1= COMBINE(AFC3FC,AFC3FC1)

    DATA
      1975        3.628423E+09  3.914954E+09  4.483944E+09  4.814742E+09
      1979        5.097439E+09  5.421261E+09  5.748482E+09  6.012719E+09
      1983        6.457303E+09  6.705852E+09  6.902776E+09

AF1FOR - DATE REVISED: 10/14/80

    ANNUAL DATA FROM 1980 TO 1985
COMMENT:
FORECAST OBTAINED BY USE OF REGRESSIONS ON AF1FUM3 OF AF1CUM1 AND AF1CUM2

    DATA
      1980        3.238216E+08  3.272212E+08  2.642371E+08  4.445839E+08
      1984        2.485494E+08  1.969234E+08
```

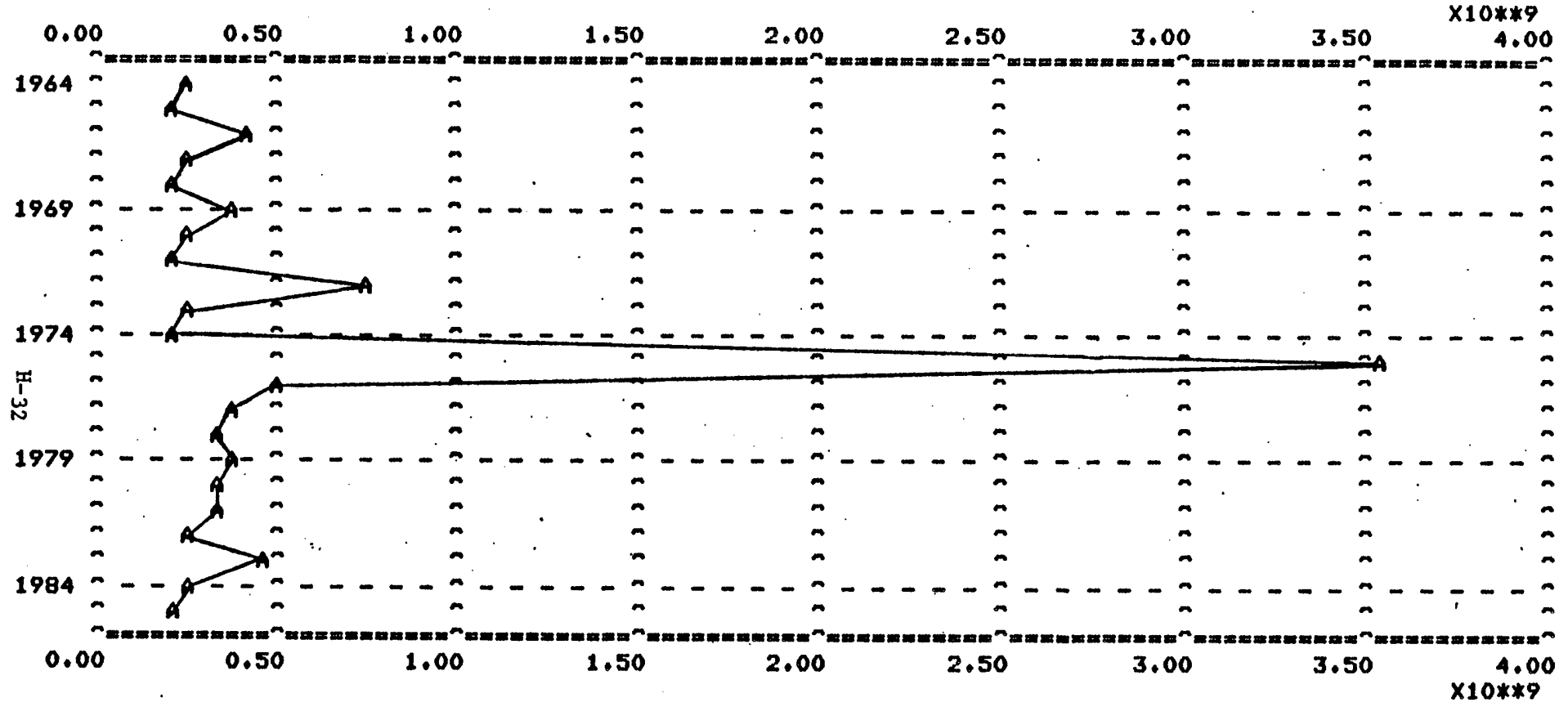


**********LEGEND**********

TIME BOUNDS: 1975 TO 1985

SYMBOL	SCALE	NAME
A	#1	AF1CUM31
B	#1	AF1FOR

****



**********LEGEND**********

TIME BOUNDS: 1964 TO 1985

SYMBOL	SCALE	NAME
A	#1	AF1FOR

****

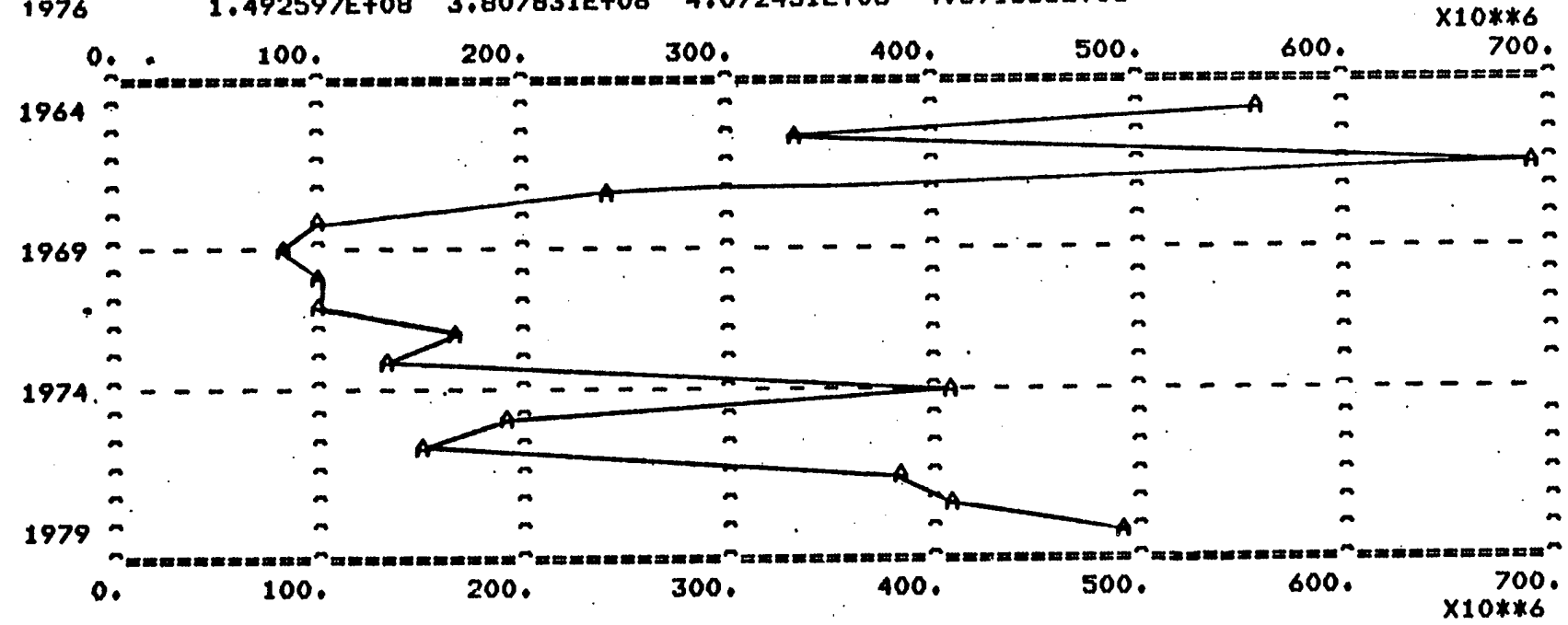
NAVY1 - DATE REVISED: 10/14/80

ANNUAL DATA FROM 1964 TO 1979

COMMENT:
NAVY SAP SALES FOR EUROPE AND CANADA IN CONSTANT 1967 DOLLARS

DATA

1964	5.593746E+08	3.330120E+08	6.896942E+08	2.449485E+08
1968	1.000882E+08	8.354117E+07	9.766621E+07	9.810266E+07
1972	1.666575E+08	1.334377E+08	4.120645E+08	1.885214E+08
1976	1.492597E+08	3.807831E+08	4.072451E+08	4.891666E+08



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	NAVY1

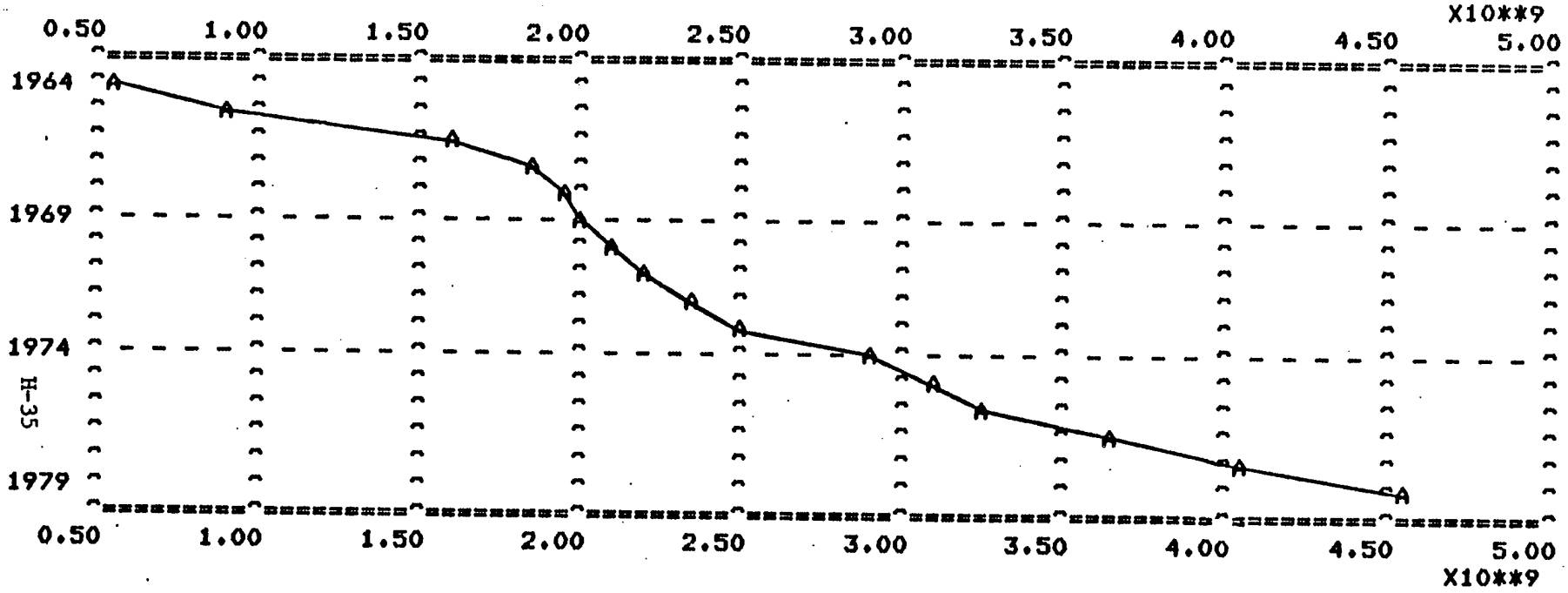
****

```
NAVY1
     NOB 16                MEAN     2.833475E+08
     MIN    8.354117E+07 MAX      6.896942E+08  STD. DEVIATION    1.887474E+08


 NAVY1CUM - DATE REVISED: 10/14/80

     ANNUAL DATA FROM 1964 TO 1979
 COMMENT:
 NAVY1CUM = CUMSUM(NAVY1)

     DATA
       1964        5.593746E+08  8.923866E+08  1.582081E+09  1.827029E+09
       1968        1.927117E+09  2.010658E+09  2.108324E+09  2.206427E+09
       1972        2.373084E+09  2.506522E+09  2.918586E+09  3.107108E+09
       1976        3.256367E+09  3.637150E+09  4.044395E+09  4.533559E+09
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	NAVY1CUM

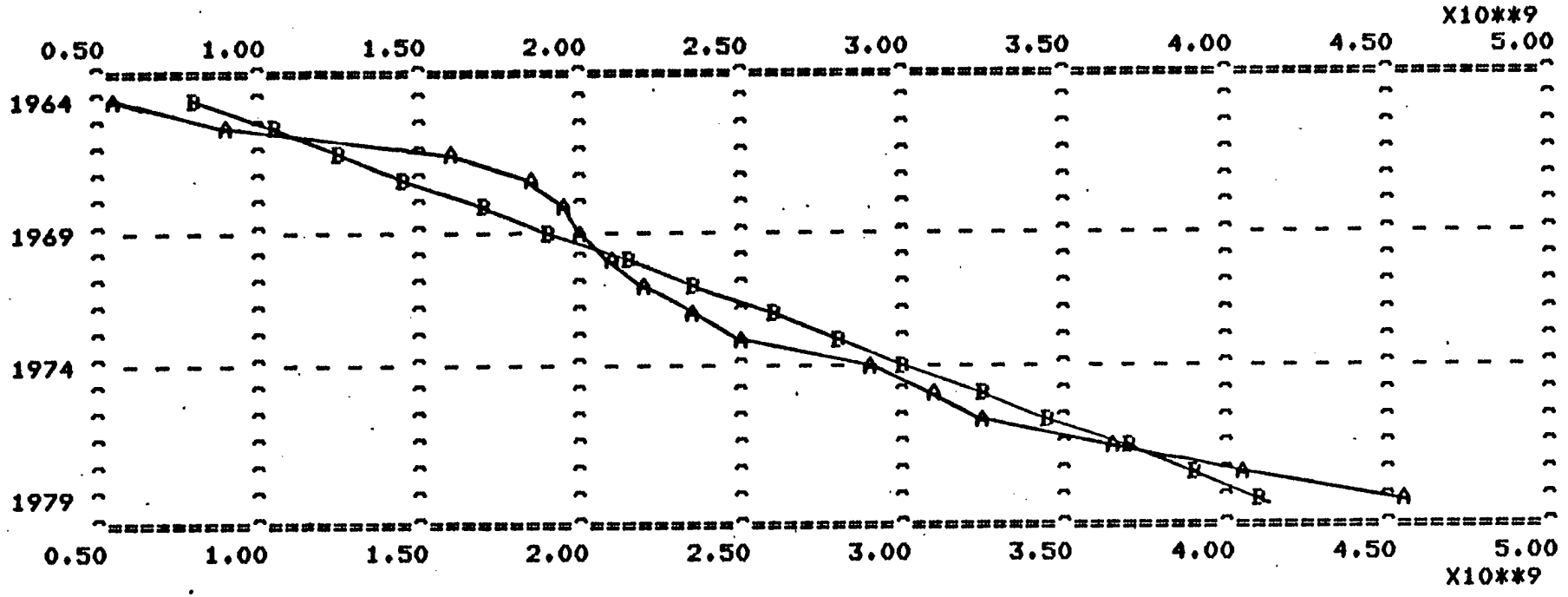
****

4: NAVY1CUM = A1+A2*TIM

NOB = 16 NOVAR = 2
RANGE = 1964 TO 1979
RSQ = 0.95455 CRSQ = 0.95131 F(1/14) = 294.04
SER = 2.38E+08 SSR = 7.900E+17 DW(0) = 0.61

COEF	VALUE	ST ER	T-STAT
A1	-2.50236E+09	2.95884E+08	-8.45725
A2	2.20911E+08	1.28828E+07	17.14780

DATE	LHS	RHS	RESIDUAL
1964	5.593746E+08	8.113032E+08	-2.519286E+08
1965	8.923866E+08	1.032214E+09	-1.398277E+08
1966	1.582081E+09	1.253125E+09	3.289556E+08
1967	1.827029E+09	1.474036E+09	3.529930E+08
1968	1.927117E+09	1.694947E+09	2.321700E+08
1969	2.010658E+09	1.915857E+09	9.480115E+07
1970	2.108324E+09	2.136767E+09	-2.844237E+07
1971	2.206427E+09	2.357680E+09	-1.512535E+08
1972	2.373084E+09	2.578590E+09	-2.055058E+08
1973	2.506522E+09	2.799500E+09	-2.929777E+08
1974	2.918586E+09	3.020413E+09	-1.018268E+08
1975	3.107108E+09	3.241323E+09	-1.342152E+08
1976	3.256367E+09	3.462232E+09	-2.058652E+08
1977	3.637150E+09	3.683146E+09	-4.599578E+07
1978	4.044395E+09	3.904056E+09	1.403397E+08
1979	4.533559E+09	4.124969E+09	4.085901E+08



**********LEGEND**********

TIME BOUNDS: 1964 TO 1979

SYMBOL	SCALE	NAME
A	#1	NAVY1CUM
B	#1	NAV1FC

****

```
EURFOR - DATE REVISED: 10/14/80

    ANNUAL DATA FROM 1980 TO 1985
    DATA
      1980        9.158080E+08  1.052549E+09  8.778540E+08  7.998188E+08
      1984        1.098139E+09  1.235600E+09

ARMY1FOR - DATE REVISED: 10/14/80

    ANNUAL DATA FROM 1980 TO 1985
COMMENT:
THE DIFFERENCE BETWEEN THE MEAN OF THE VECTOR ARMY1 AND THE CONSTANT A2 DERIVED IN THE REGRESSION
OF THE CUMULATIVE OF ARMY1 IS USED TO MODIFY THE VALUES OF ARMY1 BASED ON THE CYCLES DISPLAYED IN THE
REGRESSION: THE EQUATION IS ARMY1-(MEAN OF ARMY1)+(REGRESSION CONSTANT A2)=ARMY1FOR

    DATA
      1980        2.924529E+08  1.781899E+08  1.970553E+08  1.481963E+08
      1984        1.701339E+08  2.831739E+08

AF1FOR - DATE REVISED: 10/14/80

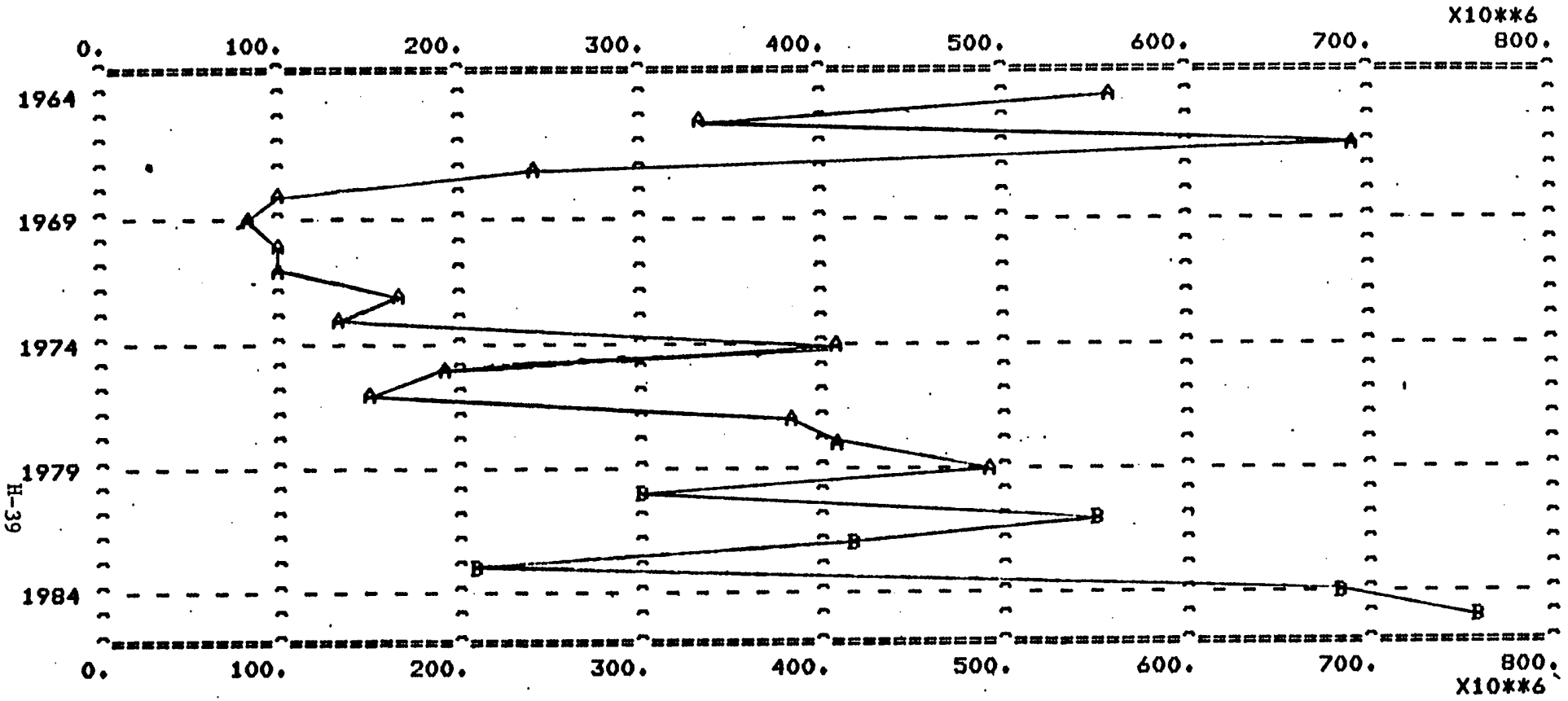
    ANNUAL DATA FROM 1980 TO 1985
COMMENT:
FORECAST OBTAINED BY USE OF REGRESSIONS ON AF1FUM3 OF AF1CUM1 AND AF1CUM2

    DATA
      1980        3.238216E+08  3.272212E+08  2.642371E+08  4.445839E+08
      1984        2.485494E+08  1.969234E+08


NAVY1FOR - DATE REVISED: 10/14/80

    ANNUAL DATA FROM 1980 TO 1985
COMMENT:
NAVY1FOR = EURFOR-ARMY1FOR-AF1FOR

    DATA
      1980        2.995336E+08  5.471378E+08  4.165614E+08  2.070385E+08
      1984        6.794555E+08  7.555028E+08
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1985

SYMBOL	SCALE	NAME
A	#1	NAVY1
B	#1	NAVY1FOR

****

```
ARMY851 - DATE REVISED: 10/16/80

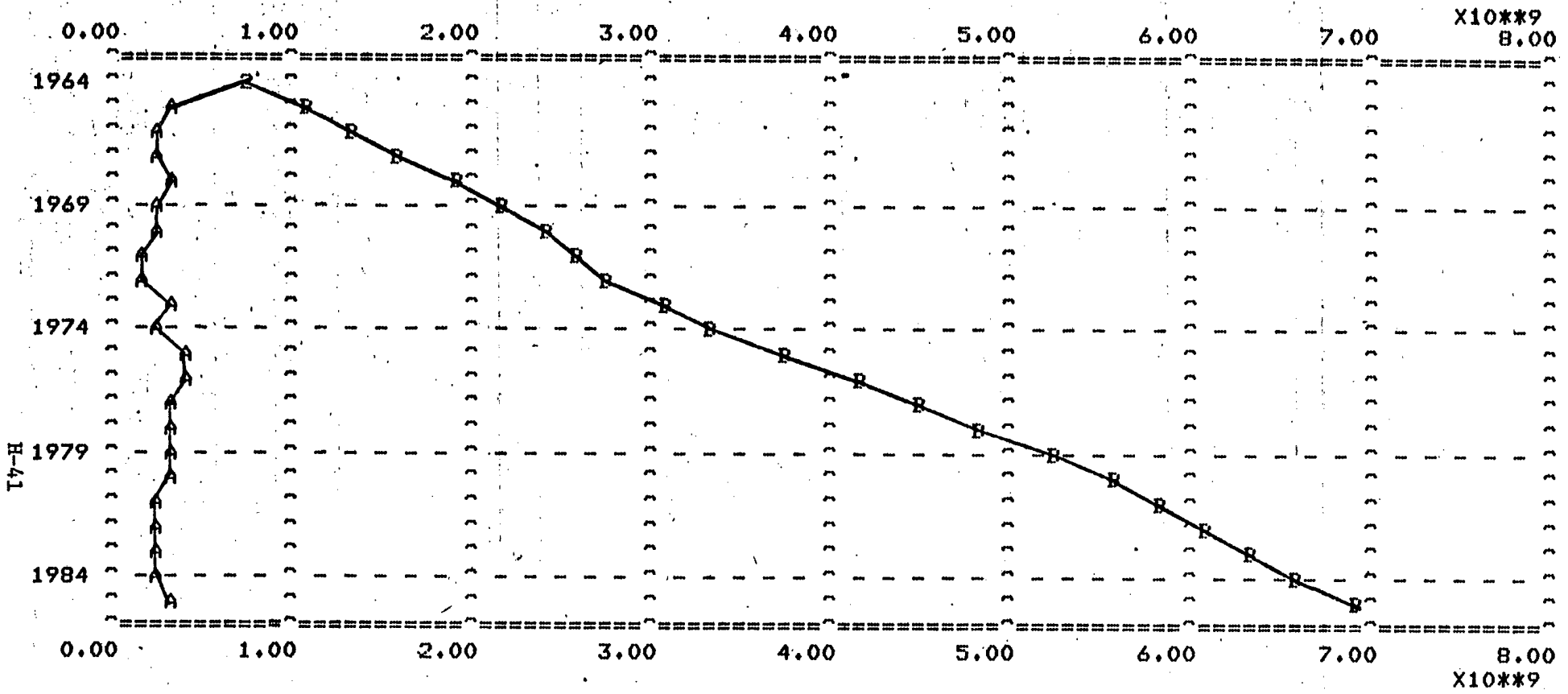
    ANNUAL DATA FROM 1964 TO 1985
COMMENT:
ARMY851 = COMBINE(ARMY1,ARM1FOR)

    DATA
      1964        7.337508E+08  3.394314E+08  2.638757E+08  2.592971E+08
      1968        3.306107E+08  2.163477E+08  2.352131E+08  1.863541E+08
      1972        2.082917E+08  3.213317E+08  2.562062E+08  4.397007E+08
      1976        3.805990E+08  3.310254E+08  3.529270E+08  3.642199E+08
      1980        3.687685E+08  2.545055E+08  2.733709E+08  2.245119E+08
      1984        2.464495E+08  3.594895E+08


ARMY851C - DATE REVISED: 10/16/80

    ANNUAL DATA FROM 1964 TO 1985
COMMENT:
ARMY851C = CUMSUM(ARMY851)

    DATA
      1964        7.337508E+08  1.073182E+09  1.337058E+09  1.596355E+09
      1968        1.926966E+09  2.143313E+09  2.378526E+09  2.564880E+09
      1972        2.773172E+09  3.094503E+09  3.350710E+09  3.790410E+09
      1976        4.171009E+09  4.502032E+09  4.854956E+09  5.219172E+09
      1980        5.587939E+09  5.842444E+09  6.115811E+09  6.340321E+09
      1984        6.586769E+09  6.946259E+09
```



**********LEGEND**********

TIME BOUNDS: 1964 TO 1985

SYMBOL	SCALE	NAME
A	#1	ARMY851
B	#1	ARMY851C

****

NAVY851 - DATE REVISED: 10/16/80

ANNUAL DATA FROM 1964 TO 1985
COMMENT:
NAVY851 = COMBINE(NAVY1,NAV1FOR)

DATA

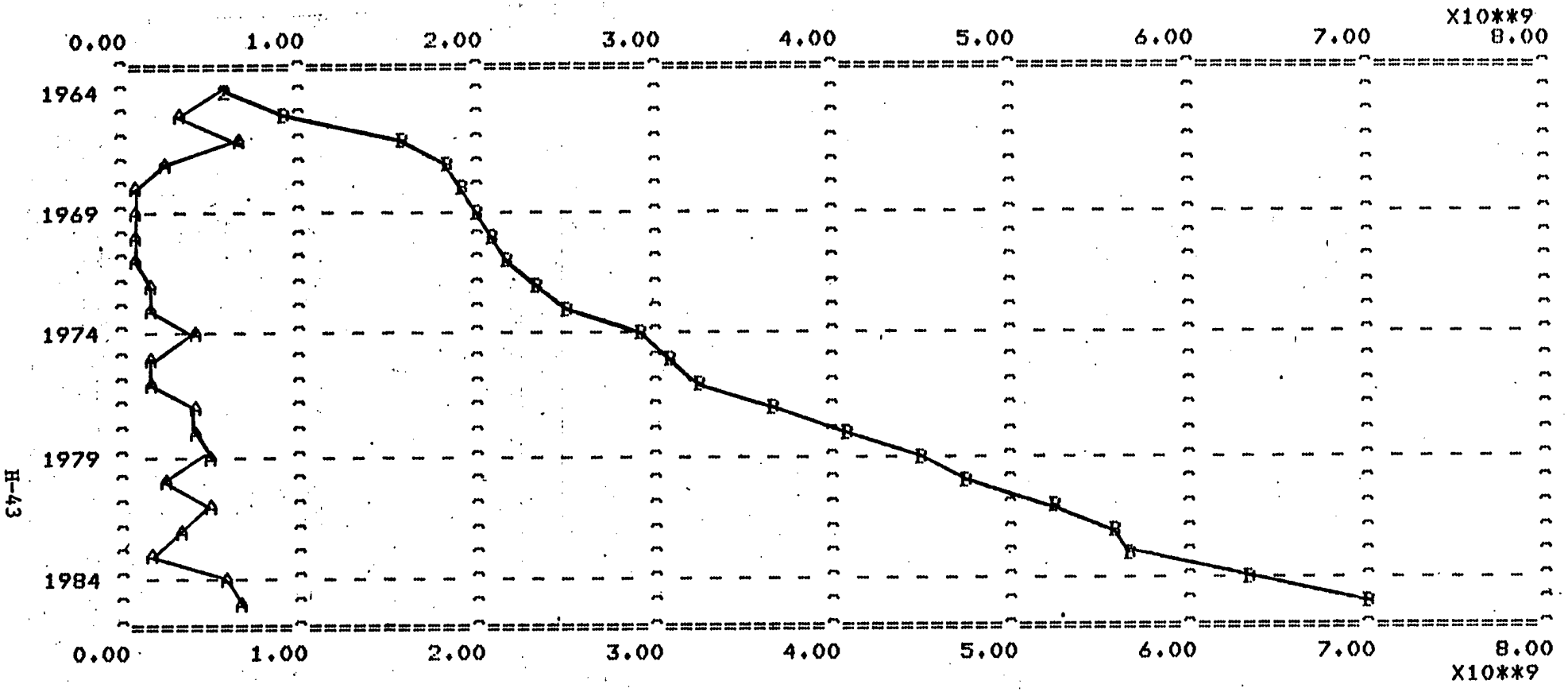
1964	5.593746E+08	3.330120E+08	6.896942E+08	2.449485E+08
1968	1.000882E+08	8.354117E+07	9.766621E+07	9.810266E+07
1972	1.666575E+08	1.334377E+08	4.120645E+08	1.885214E+08
1976	1.492597E+08	3.807831E+08	4.072451E+08	4.891666E+08
1980	2.232179E+08	4.708224E+08	3.402460E+08	1.307231E+08
1984	6.031401E+08	6.791872E+08		

NAVY851C - DATE REVISED: 10/16/80

ANNUAL DATA FROM 1964 TO 1985
COMMENT:
NAVY851C = CUMSUM(NAVY851)

DATA

1964	5.593746E+08	8.923866E+08	1.582081E+09	1.827029E+09
1968	1.927117E+09	2.010658E+09	2.108324E+09	2.206427E+09
1972	2.373084E+09	2.506522E+09	2.918586E+09	3.107108E+09
1976	3.256367E+09	3.637150E+09	4.044395E+09	4.533559E+09
1980	4.756775E+09	5.227594E+09	5.567836E+09	5.698556E+09
1984	6.301696E+09	6.980882E+09		



**********LEGEND**********

TIME BOUNDS: 1964 TO 1985

SYMBOL	SCALE	NAME
A	#1	NAVY851
B	#1	NAVY851C

****

AF851 - DATE REVISED: 10/16/80

ANNUAL DATA FROM 1964 TO 1985
COMMENT:
AF851 = COMBINE(AF1,AF1FOR)

DATA

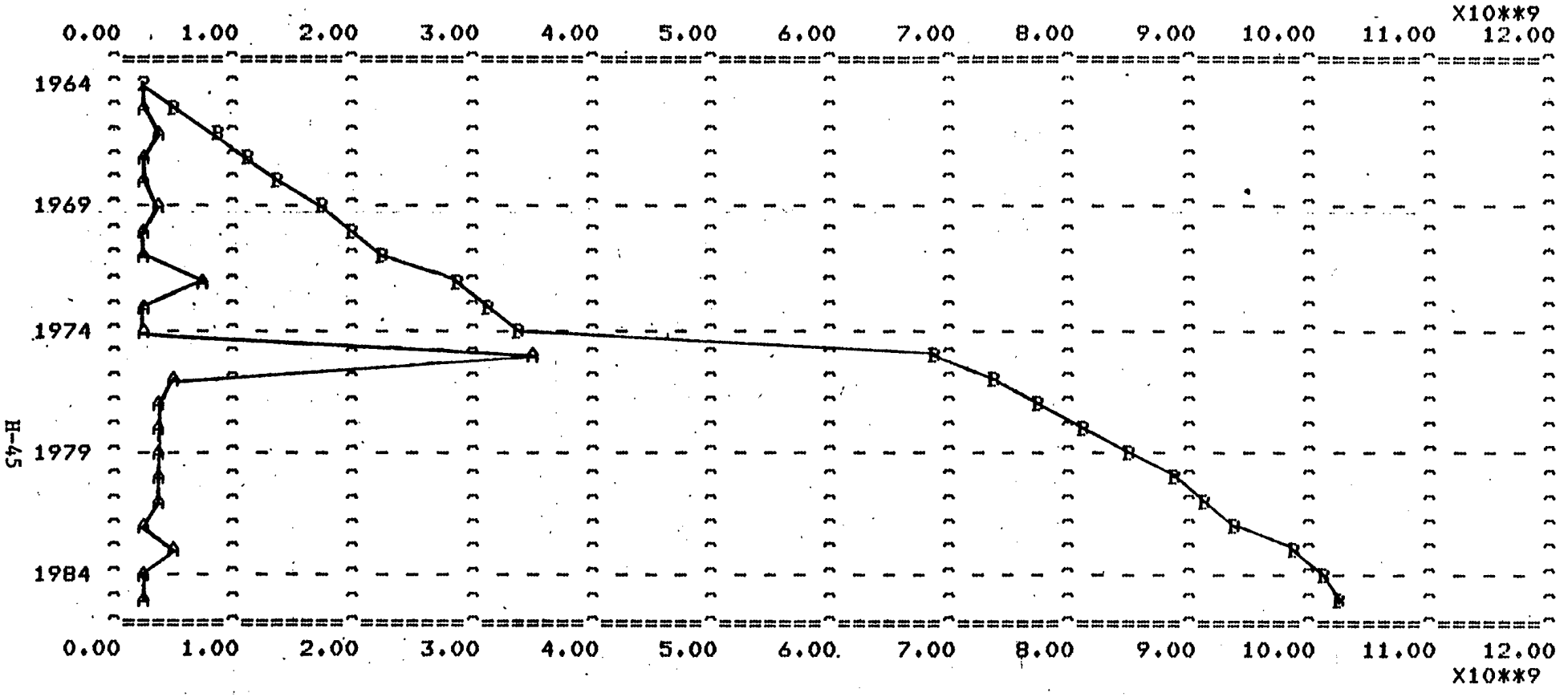
1964	2.395148E+08	2.164231E+08	4.297728E+08	2.498579E+08
1968	2.135281E+08	3.942305E+08	2.471577E+08	1.995837E+08
1972	7.335857E+08	2.485529E+08	1.969224E+08	3.550866E+09
1976	4.966971E+08	3.884524E+08	3.310950E+08	3.708639E+08
1980	3.238216E+08	3.272212E+08	2.642371E+08	4.445839E+08
1984	2.485494E+08	1.969234E+08		

AF851C - DATE REVISED: 10/16/80

ANNUAL DATA FROM 1964 TO 1985
COMMENT:
AF851C = CUMSUM(AF851)

DATA

1964	2.395148E+08	4.559378E+08	8.857106E+08	1.135568E+09
1968	1.349096E+09	1.743327E+09	1.990484E+09	2.190068E+09
1972	2.923654E+09	3.172206E+09	3.369129E+09	6.919991E+09
1976	7.416685E+09	7.805137E+09	8.136229E+09	8.507089E+09
1980	8.830910E+09	9.158132E+09	9.422369E+09	9.866953E+09
1984	1.011550E+10	1.031243E+10		



**********LEGEND**********

TIME BOUNDS: 1964 TO 1985

SYMBOL	SCALE	NAME
A	#1	AF851
B	#1	AF851C

****

Pages H-10 to H-17 illustrate the steps used to derive the Army forecast for the Western Europe and NATO Country Group. There follows a step by step discussion of the procedure including observations, rationale and results.

Page H-10

- shows the actual Army annual sales data (ARMY1) from 1964-1979.
- plots the actual Army annual sales data (ARMY1) from 1964-1979 at a plot scale of 10^6.

Page H-11

- shows statistics for ARMY1 and the data and plot for cumulative Army sales (ARMY1CUM):
  - The top portion shows the statistics developed for ARMY1. During this period:
    -- the minimum value of sales was 1.863541×10^8.
    -- the maximum value of sales was 7.337508×10^8.
    -- the mean value of sales was 3.261988×10^8.
    -- the standard deviation about the mean was 1.294617×10^8.
  - The middle portion presents ARMY1CUM data. The entry for each year was obtained by adding the actual sales experience for all years up to and including the year in question.
  - The bottom portion is a time series plot of ARMY1CUM from 1964-1979. The plot of ARMY1CUM vs time suggests that a straight line might provide a good data fit.

The postulated equation of the straight line is

(1) $ARMY1CUM = A_1 + A_2TIM$, where

-- ARMY1CUM is the cumulative Army sales data set.

-- A_1 is the intercept point of the line on the sales axis.

-- A_2 is the constant value of yearly sales increase.

-- TIM is the number of the year in the series.

Page H-12

- Equation (1) is established as the regression equation for the time series representing ARMY1CUM. A regression was performed by using the least squares method to find the straight line that best describes the data. Statistics for the regression are shown from the middle to the bottom of the page. The major particulars are as follows:

  - The number of observations (NOB) in the regression was 16.

  - The number of variables to be determined (NOVAR) was 2.

  - The years over which the regression was performed (RANGE) was 1964-1979.

  - The coefficient of determination (RSQ) was .99123. That is, the amount of variation in cumulative sales explained by equation (1) is 99.123%.

  - The standard error (SER) of sales projected using equation (1) is 1.33×10^8. That is, 67% of the cumulative sales values computed using equation (1) will be within 1.33×10^8 of the actual value.

  - The sum of the squares of the differences (SSR) between cumulative sales values and the cumulative sales values forecast by the equation is 2.494×10^{17}.

- Examination of the residuals suggests a cyclical variation.
- The values of A_1 and A_2 were found to be -3.63656×10^9 and 2.88041×10^8 respectively. Thus, the time series forecast equation derived as a result of the regression analysis is

$$(2) \quad \text{ARMY1CUM} = -3.63656 \times 10^9 + 2.88041 \times 10^8 (\text{time})$$

- The table also contains the following information:
  - Date of observation (DATE)
  - The cumulative actual sales to that date (LHS);
  - The forecast sales which result from the use of the equation (RHS).
  - The difference between the actual and forecast sales (RESIDUAL).

Page H-13

- plots the actual cumulative sales (ARMY1CUM) against the forecast cumulative sales using equation (2). From the plot:
  - there appears to be a cyclical variation between the plot of actual data points and the straight line plot of the regression equation.
  - the variation appears to be of between 5.5 and 6.5 years duration
    - -- over the first 6 years (1964-1969), the forecast value is less than the actual value.
    - -- over the next 6 years (1970-1975), the forecast value is greater than the actual value.
    - -- over the final 4 years (1964-1970), the forecast value is again less than the actual value.

- It appears rational to postulate a 6-year cyclical variation about the regression line: the last two years of the 1964-1969 cycle of actual sales form the basis for forecasting the last two years of the 1976-1981 cycle. Similarly, the first four years of the 1970-1975 cycle form the basis for forecasting the first four years of the 1982-1987 cycle.

Discussion

The differences (residuals) between the actual sales experience and the regression line forecasts for the period 1976-1979 were within the standard error of the regression for only two out of the four years. Further, the residuals increased during all four years of the cycle. If we used the regression equation directly it would most likely produce forecast values for the 1980-1985 time period considerably lower than the actual values later experienced. By the same reasoning, if we increased the actual values of 1969-1974 by the addition of a yearly sales increment equal to the mean value of the actual sales data set, it would likely provide an error in the opposite direction. That is, the forecast values would be considerably greater than the actual later experience.

Therefore, we decided to forecast the 1980-1985 time period using the 1968-1973 actual data but adding to those values the difference between the yearly sales increment of the regression equation and the mean value of the yearly sales increment resulting from actual sales experience. Since the remaining two years (1980 and 1981) of the 6-year cycle (1976-1981) were assumed to be on the positive side of the regression line, the positive difference between the two values was used. This procedure was expected to produce cumulative sales forecast values greater than the regression line forecasts.

The actual value of 1968 sales was increased by the amount of the difference between the two yearly sales increments:

Actual value of 1968 sales	+	Average yearly sales increment	-	regression yearly sales increment	=	1980 forecast increment
3.306107×10^8	+	$(3.261988 \times 10^8$	-	$2.88041 \times 10^8)$	=	3.68767×10^8

This increment was then added to the 1979 cumulative value to provide the 1980 cumulative sales forecast of 5.587939×10^9. Forecasts for 1981 through 1984 were obtained in the same way.

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- The cumulative actual value of sales are shown as X11. These values for the years 1964-1979 were shown as "LHS" of the regression analysis on Page H-12.
- The cumulative value of forecast sales using the regression equation are shown as X2. These values for 1964-1979 were shown as "RHS" in the regression analysis on Page H-12. No forecast values for 1980-1985 were obtained by adding an annual increment of 2.88041×10^8 to the cumulative actual sales value for 1979 and each succeeding year.

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- plots and compares the cumulative actual sales data through 1979 and the cumulative forecast sales data for 1980-1985 (X11) with the forecasts of cumulative sales (X2) obtained using regression equation (2).

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- regresses the data set X11 over time to determine the changes to regression equation (2) brought about by adding the forecasts for 1980-1985 to the data set ARMY1CUM.

- The regression constant A_1 is changed by approximately 6.5%.
- The regression constant A_2 is changed by approximately 4%.
- The coefficient of determination indicates that 99.5% of the variation in cumulative sales is explained by the new equation compared to 99.1% of the variation explained by equation (2). The cyclic characteristics have also been modified.

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- Shows the forecast values of yearly sales.
- Plots the actual value of sales over the period 1964-1979 (ARMY1) and the forecast value of sales for the period 1980-1985 (ARM1FOR).